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CLOSURE PLAN
AMERICAN CHEMICAL SERVICE, INC.

Prepared for:

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INTRODUCTION

American Chemical Service, Inc. operates a chemical service company in Griffith, Indiana. The facility is located near the southern boundary of the town of Griffith, as shown in Figure 1. The facility is currently configured as shown in Figure 2, an oblique aerial overview of the facility as seen from the east. American Chemical Service's business generally consists of the manufacturing of epoxidized oils, gasoline and oil additives, custom chemical batch manufacturing and until recently, the processing and reclamation of hazardous wastes.

Hazardous wastes which were managed at the facility consisted of spent halogenated solvents used in degreasing (F001), spent halogenated solvents (F002), spent non-halogenated solvents (F003 and F005) and ignitable wastes (D001). These materials were received at the facility both in drums and in bulk, via tanker truck. Spent solvents received at the facility were processed and reclaimed via distillation for resale, utilized as hazardous waste derived fuel in an industrial boiler, or processed and shipped from the site for use as cement kiln fuels. Still bottoms derived from the distillation process were also processed for use as cement kiln fuels.

American Chemical Service initially received acknowledgement of interim status from the U.S. Environmental Protection Agency (U.S. EPA) in 1982, after submittal of their Part A hazardous waste permit application. The Part A was subsequently revised October 21, 1987 and in December 1987. A copy of the original Part A application and the two subsequent amended Part A permit applications, together with acknowledgements from U.S. EPA and the Indiana Department of Environmental Management, are presented in Appendix A. Process codes for the facility are S02 - tank storage, T04 - treatment (solvent reclamation) and S01 - container storage, with process design capacities of 320,700 gallons, 50,000 gallons and 16,500 gallons, respectively.

Four units are to be closed under this plan. These include Unit A - Container Storage Area, Unit B - Reclaim Crude Storage Tank Farm, Unit C - Injectant Storage Tank Farm and Unit D - Solvent Reclamation Facility. The general locations of these units are shown in Figure 3, with additional detail presented in Figures 4, 5 and 6. One other hazardous waste management unit, the Former Solids Mixing Area, is currently being closed under a separate closure plan. This plan addresses all remaining hazardous waste management units at the facility.

American Chemical Service elected to discontinue the treatment and storage of hazardous wastes and discontinued receiving such materials effective September 5, 1990. American Chemical Service will therefore close its hazardous waste management facilities, after which time will continue to operate solely as a generator of hazardous wastes.

Conditions at the facility which have bearing on the technical approach to closure include soil and groundwater contamination. The American Chemical Service Site (which includes the facility itself, as well as some surrounding areas) has been included on the National Priorities List (NPL) for investigation and remediation under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). Specifically, three areas of the site which are near, adjacent to or partially underlying the active hazardous waste management units received waste materials prior to 1975. These areas include the On-Site Containment Area, the Still Bottoms Area and Treatment Pond #1, as identified through discussions with American Chemical Service personnel and through site characterization work performed by Warzyn Engineering, Inc. (Warzyn) on behalf of the Site PRP Group Steering Committee.

In each of these three areas, Warzyn has identified high concentrations of various organic compounds, most of which are solvents and lesser concentrations of various heavy metals (Warzyn, #1, 1989). Near-surface soils (zero to 15 feet to 20 feet in depth) are granular sands, gravels and soils exhibiting high permeabilities. The water table at the site is shallow, typically occurring from zero to six feet in depth, depending on precipitation. Based on the considerable solubilities of many of these organic compounds, it is not unexpected that such compounds have also been identified in the groundwater at the facility. Benzene, toluene, ethylbenzene and xylenes have been detected at the greatest concentrations (Warzyn, #2, 1989). Thus, any steps to be taken to remediate soils in the area of the hazardous waste management units must consider the widespread nature of such contaminants at the site, together with the mobility of such contaminants arising from high solubilities and high permeability of near-surface soils. Simple removal and replacement of soil will not be effective due to the propensity for backfilled materials to be recontaminated by surrounding soils and buried waste materials. For this reason, Baker/TSA believes that soil and or groundwater decontamination efforts must consider the facility as a whole. Based on Baker/TSA's review of information furnished by American Chemical Service, including company inspection records, storage tank assessments and certifications, the absence of reportable spills within the facility and the overall good condition of all hazardous waste tanks, piping and other appurtenant equipment, the relative contribution of contamination due to the hazardous waste management units is minimal compared to the underlying pre-1975 waste disposal areas. Thus, it is believed that soil and groundwater contamination would be most appropriately addressed through measures currently being taken under CERCLA.

For this reason, the following closure plan is directed towards the closure of above ground tanks, structures and appurtenant equipment.

Baker/TSA was retained by Eichhorn, Eichhorn & Link to prepare a closure plan for the remaining active hazardous waste management units at American Chemical Service, Inc. In preparation of this plan, Baker/TSA has reviewed and addressed requirements for closure listed under:

- 329 IAC 3-21;
- 329 IAC 3-22-3;
- 329 IAC 3-24-8;
- 329 IAC 3-31-5;

As well as guidance for closure as presented by IDEM in the following document:

- Draft: "Instructions for the Preparation of Closure Plans for Interim Status RCRA Hazardous Waste Facilities", prepared by the Indiana Department of Environmental Management, Office of Solid and Hazardous Waste Management, dated 1988.

DESCRIPTION OF FACILITY

General Information

Facility EPA ID No.:	IND016360263
Owner/Operator's Name:	American Chemical Service, Inc.
Mailing Address:	420 South Colfax Avenue Post Office Box 190 Griffith, Indiana 46319

Facility Telephone: (219) 924-4370

Facility Contact: James Tarpo, President

Standard Industry Code: 2869

Facility Description

American Chemical Service, Inc. operates a chemical service company in Griffith, Indiana. The overall operations at the facility are divided into six categories:

Non-Waste Related

- Epoxol Manufacturing - This operation produces epoxidized oils through an oxidation reaction.
- Additives Manufacturing - Gasoline and oil additives are produced on a batch reaction basis.
- Blending and Packaging - This operation blends and packages the products manufactured in the Additives plants.
- Custom Batch Manufacturing - custom batch blending and reactions are performed to the specifications of the customer. These products are then packaged and shipped.

Waste Related

- Solvent Reclamation - Spent crude industrial solvents (hazardous wastes) were reclaimed via distillation, processed, packaged and sold. The reclaimed solvents were sold as products used in paint and ink manufacturing. The reclaimed solvents were also used in the automotive industry.
- Injectant Fuels - Flammable liquid solvent by-products (hazardous wastes) are received at the facility, processed, blended and then shipped as cement kiln fuels.

The facility is located on the south side of Griffith, Indiana, as shown in Figure 1, a topographic map indicating the regional site location. The facility occupies a portion of Section 2, Township 35 North, Range 9 West of the second principal meridian. The area contained within the plant's perimeter fence comprises approximately 14 acres of land. An oblique aerial photograph, covering most of the site and all permitted hazardous waste units, is shown in Figure 2.

The facility is bounded to the north by a strip of woodlands followed by tracks of the Grand Trunk Railroad, to the east by Colfax Avenue (followed by woodlands), to the south by a service railroad yard and the Town of Griffith Sanitary Landfill and to the west by a strip of woodlands followed by a large marshy lowland area. The nearest residences are located approximately 700 feet to 750 feet from the plant's perimeter fence, south-southeast of the site on Reder Road and Colfax Avenue. Other residences are located in excess of 1,500 feet from the facility, on Colfax Avenue (south of the site) and on Avenues B, C and D, west of the site.

Geological Setting

According to published geological literature (Hartke, Hill and Reshkin, 1975), the site is situated within the Calumet Lacustrine Plain. This is an area of generally low topographic relief, formerly the bed of glacial Lake Chicago. Specifically, shallow subsurface soils beneath the facility are mapped as sand and some fine gravel of mixed water and wind laid origin. These soils are reported to occur in broad, sheet-like deposits, and to include many small areas of dune sand. These soils are also reported to include till inclusions, which are clay-rich units of varying thickness and areal distribution. The total thickness of unconsolidated soils in the area of the facility is reported by Hartke, Hill and Reshkin (1975) to be on the order of 73 feet to 131 feet.

Groundwater is reported in the above literature to occur at an elevation of approximately 620 feet above mean sea level, which is near the ground surface at the site, 630 feet to 635 feet above mean sea level.

Site Geology

Considerable subsurface exploration work, including soil borings, piezometer and monitoring well installations, has been performed within and around the fenced perimeter of the facility during current remedial investigation/feasibility study activities. In general, subsurface conditions encountered during this work correspond closely with the published geological literature.

Specifically, four soil borings, completed as monitoring wells MW-2, MW-3, MW-4 and MW-5, were advanced by Warzyn during July 1989, one at each corner of the fenced perimeter of the site. In each of these soil borings, advanced to depths of 17 feet to 23 feet, sands of varying texture were encountered to depths of 14 feet to 21 feet, in each instance, underlain by gray silty clay. Based on bail-down slug tests for each of these monitoring wells, screened between depths of seven feet to 17 feet, Warzyn (#2, 1989) reported hydraulic conductivities of 1.5×10^{-3} cm/s to 1.2×10^{-2} cm/s. Based on falling head permeability tests performed on relatively undisturbed three-inch diameter shelby tube samples, Warzyn reported permeabilities of 5.8×10^{-9} cm/s to 6.7×10^{-7} cm/s for the gray silty clay layer. This contrast in permeability, indicating that the clay unit underlying the facility is a least 1,000 times less permeable than the overlying sands, indicates that the clay unit is an effective aquitard, thus limiting groundwater contamination to the upper sand layer. Depths to groundwater were reported by Warzyn (#2, 1989) to range from 1.5 feet to 7.3 feet while drilling monitoring wells MW-2, MW-3, MW-4 and MW-5.

Surface Soils

Based on Baker/TSA's observations of the facility, all areas within and around the hazardous waste management units are covered with a layer of slag aggregate, approximately one foot in thickness. Thus, none of the naturally occurring soils are exposed in these areas.

DESCRIPTION OF WASTE MANAGEMENT UNITS TO BE CLOSED

There are four principal waste management units to be closed under this plan. These units represent all waste management units listed on the current Part A permit application and include:

- Unit A - Container Storage Area;
- Unit B - Reclaim Crude Storage Tank Farm;
- Unit C - Injectant Storage Tank Farm; and,
- Unit D - Solvent Reclamation Facility.

Each of these units is described in detail below. Photographs of each unit are presented in Figure 7. Process and unit of measure codes, waste type, standard chemical names, U.S. EPA hazardous waste numbers, time period of use, dimension and Part A permit line references are summarized for each unit and vessel in Table 1. Copies of the following documents are included in Appendix A:

- The original Part A Permit Application (EPA Forms 3510-1 and 3510-3) dated February 11, 1982;
- An October 21, 1987 revision to the Part A Permit Application; and,
- The December 10, 1987 revision to the Part A Permit Application (currently in effect).

Unit A - Container Storage Area

The Unit A Container Storage Area consists of an elevated concrete paved base measuring approximately 55 feet wide by 60 feet long under roof and approximately 25 feet wide by 45 feet long directly east of the roofed portion. The container handling area is situated atop a concrete slab raised approximately 48 inches above the surrounding ground surface, pitched to a 100 gallon capacity concrete sump basin located near the center of the slab. Unit A also includes Tank 20, a 1,000 gallon capacity stainless steel mixing vessel equipped with complete secondary containment of concrete construction, three waste transfer pumps, a filter, straining bin and various ancillary piping as indicated in Table 1.

Unit A is centrally located within the plant as shown in Figure 3. A plan view of the unit is shown in Figure 4 while construction details of the unit are presented in Figure 6.

Unit A was used for processing 55-gallon drums. Crude spent solvents were unloaded from drums in this area by pumping to storage tanks in Unit B to await reclamation via distillation. Flammable liquid solvents were unloaded from drums in this area by pumping to storage tanks located in Unit C. In addition, solid hazardous wastes associated with RCRA operations were packaged and stored in Unit A prior to shipment off-site as kiln fuel. The designed storage capacity for Unit A is 300 drums or 16,500 gallons, corresponding to line number 3 on the Part A permit, process code S01 (container storage) and the listed process design capacity of 16,500 gallons.

Unit B - Reclaim Crude Storage Tank Farm

Unit B is an above ground storage tank farm consisting of thirteen A283C type carbon steel tanks ranging in capacity between 2,750 gallons and 19,500 gallons each. These tanks are of two configurations, nine of the 13 tanks being vertical cylinders supported by legs founded on a concrete base, with the remainder being flat-bottom vertical cylinders resting directly on a concrete slab base. Included are appurtenant equipment such as three pumps, a filter and associated schedule 40 steel piping (approximately 1,850 feet of two-inch and three-inch diameter piping). Tanks located in Unit B are: #116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 1A and 1B. The unit is enclosed with earthen dikes constructed of clay with a slag aggregate cover approximately three feet high above the surrounding ground surface.

Also included in Unit B is a physically separate tank, #1002, used to store hazardous waste derived industrial boiler fuel. Tank 1002 is located approximately 75 feet east of the Unit B dike wall and is included in Unit B for closure purposes since this tank has historically been subject to routine inspection as part of Unit B. Tank 1002 is a cylindrical, flat-bottom tank on a slag base constructed of A283C carbon steel, and has a storage capacity of 11,000 gallons. Appurtenant equipment associated with tank #1002 includes a boiler feed pump and approximately 300 feet of one-inch diameter pipe for the transfer of fuel to the boiler located adjacent to the main office. The area around tank #1002 is enclosed by earthen dikes constructed of clay with a slag aggregate cover approximately three feet high above the surrounding ground surface.

Pertinent information for Unit B is presented in detail in Table 1. The general location of the unit is presented in Figure 3, with a detailed plan view of the unit and appurtenant equipment presented in Figure 4. Unit B is distinguished as having the only underground piping associated with any of the units. Piping between unloading ramp #1 and Unit B is positioned beneath the ground surface, passing beneath the solvent product storage tank farm immediately west of the unit.

Unit C - Injectant Storage Tank Farm

The Unit C Injectant Storage Tank Farm is an above ground storage tank facility consisting of eight A283C carbon steel tanks ranging in capacity between 16,000 gallons and 24,000 gallons each. These tanks are cylindrical, with flat bottoms and rest on a slag aggregate base. Included are appurtenant equipment such as four pumps, seven filters, a Gorator particle size reducer and associated schedule 40 steel piping (approximately 1,250 feet of two-inch and three-inch diameter piping). Tanks located in Unit C are #202, 203, 204, 205, 206, 210, 211 and 212. The unit is enclosed with earthen dikes constructed of clay with a slag aggregate cover, approximately three feet high above the surrounding ground surface. Unloading ramp #3 is located adjacent to the north side of Unit C. Wastes received in bulk tank trucks are unloaded at this location.

Unit C is located in the east central portion of the facility's fenced perimeter, as shown in Figure 3. A plan view of the unit, also depicting appurtenant equipment, is presented in Figure 4.

Unit D - Solvent Reclamation Facility

Unit D, the Solvent Reclamation Facility, includes four solvent recovery stills, #1, #2, #3 and #7. Within these stills, crude spent solvents were reclaimed in a batch process, utilizing steam as the process heat. Distillation is performed at pressures ranging from neutral (atmospheric) to negative (15 inches Hg vacuum). The vapors were condensed and then packaged as solvent products.

Solvent recovery stills #1, #2 and #3 are vertical cylindrical units constructed of carbon steel and supported on I-beam legs. Stills #1, #2 and #7 are 5,500 gallons in capacity each, with still #3 being somewhat smaller, with a capacity of 3,500 gallons. Still #7, constructed of stainless steel, is horizontally oriented and supported by saddles. Supports for each of these stills are situated atop concrete foundations. Appurtenant equipment associated with the stills includes four pumps, three heat exchangers and approximately 900 feet of two-inch and three-inch diameter schedule 40 steel piping, valves and fittings. Detailed pertinent information is presented in Table 1. Unit D is generally located as shown in Figure 3, with a detailed plan view presented in Figure 5. Appurtenant equipment is also graphically depicted in Figure 5.

REMOVAL AND DISPOSAL OF WASTE INVENTORY

The removal and proper disposal of hazardous waste inventory is fundamental to the closure of a storage and treatment facility. American Chemical Service discontinued receiving hazardous waste at the facility on September 5, 1990. Since that time, no additional wastes have been received by the facility.

Prior to September 5, 1990, American Chemical Service anticipated the closure of its hazardous waste storage and treatment facilities. Thus, waste inventories were systematically reduced, beginning in May of 1990. In addition to reducing its normal inventories of liquid spent solvents and kiln fuels, settled solids and semi-solids which had been present in most of the hazardous waste tanks have been manually removed and shipped to Cadence Chemical Resources in Chanute, Kansas and Louisville, Nebraska for use as auxiliary fuels and to Marine Shale Processors in Morgan City, Louisiana for thermal/pozzolonic processing into aggregate products. As of September 18, 1990, a total of 39,712 gallons of settled solids and semi-solids have been removed from facility tank storage and properly disposed of at these locations.

Consistent with National Contingency Plan protocols, these processes have provided significant reductions in the volume, toxicity and mobility of wastes formerly in inventory at the facility.

Currently, only a relative small quantity of hazardous wastes are in inventory at the facility. These include hazardous waste derived fuel and miscellaneous hazardous wastes as shown in Table 2.

DECONTAMINATION OF TANKS AND STRUCTURES

According to IDEM guidance for closure, decontamination procedures to be specified for tanks and structures must consider the physical and chemical character of the wastes stored therein, as well as the tank's or structure's final disposition (i.e., disposal of the tanks or structures as hazardous waste, storage of product or other uses). At American Chemical Service, wastes which were managed included: spent halogenated solvents, spent non-halogenated solvents and ignitable wastes derived primarily from the paint and printing industry. These wastes consist of the following chemicals:

- Methylene chloride, 1,1,1-trichloroethylene, trichloroethylene, perchloroethylene, 1,1,1-trichloroethane;
- Acetone, methanol, methyl ethyl ketone, isopropyl alcohol, toluene, hexane, methyl isobutyl ketone, butyl acetate, xylene, mineral spirits, butyl cellosolve, butanol, ethyl acetate.

All of these compounds are to a greater or lesser degree, volatile solvents characterized by high respective Henry's Law constants. Thus, these compounds, when exposed to air, have a strong tendency to evaporate. Being derived principally from the paint and printing industries, however, most of the managed wastes also contain metal-based pigments and pigment solids. The solvents can occur in either visible liquid or non-visible vapor states, but the solids and semi-solids, most of which contain metallic constituents and pigments, form a stable solid matrix which is visible. In practical terms relative to equipment decontamination, the liquid phase solvent portion of the wastes are easily pumpable, while pigment and pigment solids tend to settle out of solution and accumulate inside the various vessels.

The following decontamination procedures were developed to yield decontamination which is sufficient for the future use of the equipment. All tanks, vessels and appurtenant equipment will be used for the storage and processing of additive raw materials and products after closure.

Decontamination Procedures

In consideration of appropriate levels of equipment decontamination and the characteristics of the managed wastes, Baker/TSA, in conjunction with American Chemical Service, has developed the following decontamination and verification procedures for the facility units. These procedures consider the following general types of equipment and structures requiring decontamination:

- Tanks and Vessels;
- Container Storage Area and Concrete Surfaces; and,
- Pipes, Pumps, Filters, Etc.

Tanks and Vessels

The tanks and vessels at American Chemical Service range in size from 1,000 gallons (Tank 20) to 24,000 gallons (Tank 212). Each tank is equipped with a bolt-on manway through which access may be easily gained. In general, all of the tanks have been emptied of inventory and the great majority of settled solids have been removed during inventory reduction. Based on Baker/TSA's visual inspections of the tanks through their open manways, various, but only very small quantities of settled solids remain in any of the vessels. The quantity of solids visually estimated to remain varies from approximately 0.75 to 2.75 cubic feet for each vessel. Thus, decontamination procedures focus on the cleaning and removal of all remaining solids and residues currently present in each tank. The following procedures will be followed:

- The work space in which hazardous materials will be handled for each vessel will be cordoned off using appropriate warning tape.
- An ingress/egress point will remain open, serving as a contamination reduction zone for facility workers.
- The portion of the ground surface directly in front of and beneath the manway, together with a sufficiently large work area, will be covered with four-mil polyethylene sheeting in order to contain miscellaneous spills and/or drippage during vessel cleaning.
- The bolt-on manway will be removed to allow access into the tank.
- Tank entry will be performed in accordance with American Chemical Service's confined space entry procedure (Appendix D), with personal protective equipment described therein.
- Solid residues will be manually scraped and brushed from the interior surfaces of the vessel until no visible wastes or waste residues remain. The solid materials will be picked up from the bottom of the tank manually or through the use of a vacuum. These materials will be containerized and disposed of as hazardous waste.

<u>Tank and Vessel Closure Criteria</u>

Cleanup criteria for tank and vessel closure shall be based on the methods listed below. Once the vessel has been decontaminated, the certifying professional engineer (or his qualified representative, will perform the following inspections:

- Visual inspection of the vessel interior and exterior. Criteria for cleanup shall be the removal of <u>all</u> visible hazardous wastes and hazardous waste residues from the vessel. To be acceptable, the tanks must be visibly clean and dry.
- Volatile Organic Vapors - Using an HNu photoionization detector, the atmosphere inside the tank will be analyzed for total volatile organic vapors. The HNu will be calibrated using isobutylene calibration gas to read in parts per million (ppm) for the appropriate compound, i.e., 1,1,1-trichloroethylene, toluene, etc., based on the previous content of the tank. Calibration procedures will be in accordance with the manufacturer's instructions, a copy of which is presented in Appendix E. A 10.2 electron volt lamp shall be utilized, providing sufficient ionization energy for volatile compounds handled at this site. Total volatile organic vapor concentrations will be acceptable when readings of equal to less than the ambient background concentrations are reliably measured inside the vessel. Background readings are expected to be on the order of 0.2 ppm to 1.0 ppm for this facility. If ambient background concentrations exceed 1.0 ppm, or if interference due to humidity in excess of 85 percent are encountered, the test will be repeated when weather conditions allow.
- Explosive Vapors - The atmosphere inside the tank will be monitored using an explosive vapor/gas detector which directly measures the lower explosive limit (LEL)

in percent. LEL concentrations acceptable for closure will be no greater than zero (0) percent.

- For vessels which fail to meet the above closure criteria after initial cleaning, the decontamination procedure will be repeated until those vessels meet the criteria.

Baker/TSA believes that the above listed closure criteria are sufficient and appropriate considering the characteristics of the managed wastes and the future uses of these vessels, i.e., for the storage of additive raw materials and products. Visual observations will be sufficient to determine whether solid residues containing metallic pigments have been removed and the volatile organic vapor scan and explosive vapor scan will be sufficient to establish that the tanks no longer contain volatile organic compounds. These criteria are also sufficient and appropriate to establish decontamination of the tanks prior to their future use.

Container Storage Area and Concrete Surfaces

The container storage area includes a concrete slab measuring 55 feet wide by 60 feet long (under roof) and an adjacent portion of the concrete slab measuring 25 feet wide by 45 feet long (with no roof). Decontamination of this area and any other concrete surfaces within the hazardous waste management unit boundaries, will be performed by manually scraping and brushing of the surface until it is visibly clean and free of hazardous waste and/or hazardous waste residue. If the concrete surfaces cannot be cleaned of all visible hazardous waste and/or residue, sandblasting of the affected surface(s) will be performed. All solid materials, including sandblasting grit, if used, will be collected, containerized and managed as hazardous waste.

Any sand blasting activities will be accompanied by dust/airborne solid control, such that no solid materials will be allowed to be wind blown to areas outside the physical boundary of the hazardous waste management unit. These measures will include the erection of fiber reinforced plastic sheet barriers, constructed to enclose the work area. Incidentally spilled or wind carried solids or grit will be manually shoveled or vacuumed up, containerized and managed as hazardous wastes.

Container Storage Area Closure Criteria

The Container Storage Area and other concrete surfaces will be considered clean based on the visual inspection of the professional engineer. Acceptable decontamination will require the removal of all visible hazardous waste and hazardous waste residues. Each surface must be clean and dry, prior to acceptance. Considering the chemical and physical characteristics of the wastes managed at the facility, Baker/TSA believes that these procedures are adequate to ensure decontamination appropriate for the storage of containerized products and raw materials.

Pipes, Pumps, Filters, Etc.

A total of approximately 300 feet of one-inch diameter, 2,600 feet of two-inch diameter and 1,050 feet of three-inch diameter schedule 40 steel piping will be cleaned and decontaminated under this closure plan. Included are numerous gate valves and fittings (unions, elbows, tees, nipples, bushings, caps, plugs, etc.). Other appurtenant equipment to be decontaminated includes rotary pumps (total of 16), filters (total of 10), one Gorator particle size reducer and three heat exchanger units. With the exception of approximately 150 feet of piping between the unloading ramp #1 unloading pump and Unit B, all piping and appurtenant equipment are located above ground. The single buried pipe trends beneath the reclaim product tanks and their concrete slab foundation.

Decontamination of this equipment will be performed by first purging all liquids and loose solid materials from the lines using compressed nitrogen available on site. Currently, little or no free liquids or solid materials are present in the piping system. Once this is done, all piping will be systematically disassembled and each section of pipe will be manually swabbed clean using a shaft-mounted cotton (or other effective material) swab. All pumps and filtering units, as well as the Gorator, will be disassembled and manually cleaned, with particular care given to the wetted surfaces formerly in contact with the hazardous waste. Any and all residues generated during these activities will be collected and disposed of as hazardous waste. Some equipment, including approximately 100 feet to 200 feet of piping, contain solidified materials and will not be practical to clean. All appurtenant equipment which cannot be cleaned of hazardous waste and hazardous waste residue, will be disassembled, cut as necessary and disposed of as hazardous waste.

The 150' of three-inch schedule 40 steel pipe which runs underground from unloading ramp #1 to storage tanks in Unit B will be closed by first purging the line with nitrogen to remove any remaining liquid. This will be followed by mechanically swabbing the line until clean and testing the integrity of the line by pressurizing it with nitrogen. If the integrity test indicated the piping is tight (not subject to measurable leak down over a 30 minute period), both ends of the pipework will be capped. If the integrity test fails, the length of pipe will be sealed with a portland type 1 cement grout.

Appurtenant Equipment Closure Criteria

Upon completion of cleaning operations described above, and periodically during the cleaning process, the professional engineer or his qualified representative will visually inspect the work. Acceptance of closure will be based on the following criteria:

- Visual Inspection - All equipment must be clean and free of all hazardous waste and hazardous waste residues.
- Volatile Organic Vapors - All equipment, including the interiors of the disassembled piping, will be checked for volatile organic vapors as described in the section pertaining to vessel decontamination. Measurement criteria for closure shall also be the same as for vessels.
- Explosive Vapors - All equipment will be checked for explosive vapors as discussed in the vessel decontamination section. Measurement criteria for closure shall also be the same as for vessels.

SUBSURFACE SOILS AND GROUNDWATERS

Subsurface conditions at this site are characterized by existing soil and groundwater contamination. The lateral extent of contamination is broad in relationship to the hazardous waste management units being closed, underlying the fenced boundary of the site and areas beyond. Prior to 1975, a variety of wastes were buried at the site. Field exploration activities, sampling and analysis have shown that these contaminants are associated with the buried wastes on and south of the current facility.

Based on Baker/TSA's review of information furnished by the facility, the relative contribution to subsurface contamination due to active hazardous waste management activities is minimal compared to that derived from pre-1975 waste disposal activities. This conclusion is based on the following:

- Company inspection records for the hazardous waste management units;
- Storage tank and vessel assessments/certifications (presented in Appendix B and Appendix C);
- The absence of reportable hazardous material spills at the facility; and
- The overall good condition and maintenance of the hazardous waste management units.

Soils underlying the site to a depth of approximately 15 feet consist of permeable sands. Thus, the contaminants in the soil and groundwater are mobile and can migrate with groundwater flow. For this reason, any soil decontamination performed in association with the closure of active hazardous waste management units would be ineffective due to the propensity of such areas to be recontaminated by surrounding soils and groundwater.

In order to manage sites such as this, the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) was legislated enabling the creation of a "Superfund" mechanism. In addition to the expected ineffectiveness of potential remedial measures which might be taken with respect to the active hazardous waste management units at this site, the selection of cleanup criteria for closure, the separate development of remedial measures and all activities of this nature will unnecessarily duplicate the efforts currently underway under CERCLA. The present CERCLA activities schedule calls for the remedial investigation to be released in the near future and the feasibility study to be completed in early 1991. For these reasons, the selection of cleanup criteria, soil/groundwater sampling and soil/groundwater cleanup and plans for post-closure care have been omitted from this closure plan at this time.

SCHEDULE FOR CLOSURE

American Chemical Service must treat, remove or dispose of all hazardous waste in accordance with the approved closure plan within 90 days after the approval of the closure plan by IDEM. Closure activities must be complete within 180 days after approval of the closure plan. A schedule for closure which meets these and other applicable requirements is presented in Table 3.

AIR EMISSIONS

Little waste remains in inventory at American Chemical Service. In addition, the majority of this material has already been containerized. With the exception of hazardous waste derived fuel, only the solid, essentially dry residues remain in the storage units. Thus, sand blasting, if performed, in the container storage area and on other concrete surfaces, is anticipated to be the only closure process with significant potential to general air emissions. If generated, such emissions are anticipated to be particulate in nature.

Such emissions will be controlled during closure by erecting temporary shelters constructed of fiber reinforced plastic sheeting, with such dust generating activities to be performed inside. If such measures prove to be inadequate, as evidenced by visible dust or particulate emissions outside the work area, such activities will be halted until effective controls are in place.

DESCRIPTION OF EQUIPMENT CLEANING

All tools and equipment which become contaminated during closure will be thoroughly cleaned and decontaminated upon completion of closure. These activities will be performed on a large sheet of four-mil polyethylene plastic in order to facilitate collection and disposal of any resultant residues as hazardous waste.

PERSONNEL SAFETY AND FIRE PREVENTION

Closure activities specified in this plan will be performed in accordance with the "Site Safety and Health Plan for Operations Conducted under the Resource Conservation and Recovery Act of 1976 (RCRA)", developed by American Chemical Service, Inc. based on the requirements of the Occupational Safety and Health Administration, 29 CFR, Part 1910. Details of this plan are presented in Appendix D. Elements included in this plan are as follows:

- Key Personnel;
- Task Risk Analysis;
- Employee Training Program;
- Personnel Protective Equipment;

- Medical Surveillance Program;
- Air Monitoring Program;
- Site Control Measures;
- Decontamination Procedures;
- Standard Operation Procedures;
- Contingency Plan; and,
- Confined Space Entry Procedures.

This plan was prepared by American Chemical Service. Baker/TSA makes no representation as to the effectiveness, appropriateness nor completeness of health and safety measures outlined therein.

CLOSURE CERTIFICATION

Upon completion of closure activities, American Chemical Service and an independent Indiana Registered Professional Engineer who is not an employee of American Chemical Service or its affiliates, will certify that closure has been performed in accordance with the requirements of the approved closure plan. Certification by both the owner/operator and independent engineer will be transmitted to the IDEM within 60 days after completion of closure and no more than 240 days from the date of closure plan approval.

Together with certification of closure, a closure documentation report shall be submitted. This report will include.

- The volume of waste and waste residue removed;
- A description of the method of waste handling and transport;
- Waste manifest numbers or copies of manifests from the removal of waste and waste residues;
- A description of the sampling and analytical methods used;
- A chronological summary of closure activities and costs involved;
- Photo documentation of closure; and,
- Tests performed, methods and results.

STATUS OF FACILITY AFTER CLOSURE

Following closure, the facility will generate hazardous waste and store more than 1,000 kg/month for less than 90 days.

CERTIFICATION REGARDING POTENTIAL RELEASES FROM SOLID WASTE MANAGEMENT UNITS

In accordance with the requirements of the Hazardous and Solid Waste Amendments of 1984, American Chemical Service has completed and signed the required certification form. This form is provided in Appendix F.

COST FOR CLOSURE

An estimate of costs associated with closure, considering the current condition of the facility, is presented in Table 4. Information as to financial assurance for closure is presented in Appendix G.

REFERENCES CITED

Hartke, E. J., Hill, J. R. and Reshkin, M. 1975 "Environmental Geology of Lake and Porter Counties, Indiana - An Aid to Planning", Department of Natural Resources Geological Survey Special Report II.

Warzyn Engineering, Inc. (#1), 1989, "Phase I Soil/Sediment Characterization, ACS CERCLA Site, Griffith, Indiana", Prepared for: Steering Committee, ACS Site PRP Group.

Warzyn Engineering, Inc. (#2), 1989 "Phase I Groundwater Characterization, ACS CERCLA Site, Griffith, Indiana", Prepared for: ACS Steering Committee, ACS Site PRP Group.

TABLES

TABLE 1

DESCRIPTION OF WASTE MANAGEMENT UNITS TO BE CLOSED
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

LEGEND KEY FOR CHEMICAL NAMES

Table 1 Reference	Chemical
a	Methylene Chloride, 1,1,1 Trichlorethylene Trichlorethylene, Perchloroethylene
b	Acetone, methanol, methyl ethel ketone, isopropyl alcohol, toluene, hexane, methyl isobutyl ketone, butyl acetate, xylene mineral spirits, butyl cellosolve, butanol, ethyl acetate
c	All of the above, chlorinated not over 20% of the total concentration
d	methanol, alcohol, butanol
e	Methylene chloride, 1,1,1 trichloroethane, trichloroethylene, perchloroethylene, acetone, methanol, methyl ethyl ketone, alcohol, toluene, hexane, methyl isobutyl ketone, butyl acetate, xylene, mineral spirits, butyl cellusolve, butanol, ethyl acetate

LEGEND KEY FOR TANK TYPES

Table 1 Reference	Tank Type
a	Vertical on legs on a concrete slab
b	Vertical with a flat bottom on a concrete slab
c	Vertical with a flat bottom on a slag foundation
d	Horizontal on saddles

LEGEND KEY FOR UNIT OF MEASURE CODES

Table 1 Reference	Chemical
G	Gallons

TABLE 1 (continued)
UNIT A CONTAINER STORAGE AREA AND APPURTENANT EQUIPMENT
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

Item	Description	Process Code	Capacity (gallons)	Unit of Measure Code	Chemical Name(s)	Waste Code(s)	Period of Use	Reference Line on Part A
Container Storage Area	Drum unloading dock and container storage area 55' W x 60' L, plus an area 25' W x 45' L	SO1	16,500	G	c, d, e	D001, F001, F002, F003, F005	1982 - Present	3
Tank 20	Stainless steel tank, on legs, 5.5' dia x 5.5' ht	SO2	1,000	G	c	D001, F001, F002, F003, F005	1981 - Present	1

APPURTENANT EQUIPMENT IN AND ASSOCIATED WITH RCRA UNIT A - CONTAINER STORAGE AREA:

1. Pumps
   a. Tank 20 transfer pump used for transfer of drum unloaded material to Unit C.
   b. Drum unloading pump used for transfer of material from Unit A drums to Units B and C.
   c. Tank 20 to tank 20 transfer pump.
2. Filters
   a. Filter #1 associated with drum unloading pump located in Unit A.
   b. Straining bin used for solids removal, associated with tank 20.
3. Piping*
   a. Piping for transfer from drum unloading pump to Unit B, 2" dia x 250' total length.
   b. Piping for transfer from drum unloading pump to Unit C, 2" dia x 50' total length.
   c. Piping for transfer from tank 20 transfer pump to Unit C, 2" dia x 250' total length.

*Piping is schedule 40 iron and includes gate valves and fittings (unions, elbows, tees, nipples, bushings, caps, plugs, etc.).

TABLE 1 (continued)
UNIT B RECLAIM CRUDE TANK FARM
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

Tank Number	Description			Process Code	Capacity (gallons)	Unit of Measure Code	Chemical Name(s)	Waste Code(s)	Period of Use	Reference Line on Part A
	Item	Tank Type	Dimensions (feet)							
116	Tank	a	12' dia x 12' ht	S02	10,800	G	b	D001, F003, F005	1982 - Present	1
117	Tank	a	12' dia x 12' ht	S02	10,800	G	b	D001, F003, F005	1982 - Present	1
118	Tank	a	12' dia x 12' ht	S02	10,800	G	b	D001, F003, F005	1982 - Present	1
119	Tank	a	12' dia x 12' ht	S02	10,800	G	b	D001, F003, F005	1982 - Present	1
120	Tank	a	9' dia x 12' ht	S02	6,000	G	b	D001, F003, F005	1981 - Present	1
121	Tank	a	10' dia x 18' ht	S02	10,500	G	b	D001, F003, F005	1981 - Present	1
122	Tank	a	10' dia x 18' ht	S02	10,500	G	b	D001, F003, F005	1981 - Present	1
123	Tank	b	10' dia x 33' ht	S02	19,500	G	b	D001, F003, F005	1978 - Present	1
124	Tank	b	10' dia x 33' ht	S02	19,500	G	b	D001, F003, F005	1978 - Present	1
125	Tank	b	10' dia x 33' ht	S02	19,500	G	b	D001, F003, F005	1978 - Present	1
126	Tank	b	10' dia x 33' ht	S02	19,500	G	b	D001, F003, F005	1978 - Present	1
1A	Tank	a	6.5' dia x 10' ht	S02	2,750	G	b	D001, F003, F005	1981 - Present	1
1B	Tank	a	6.5' dia x 10' ht	S02	2,750	G	b	D001, F003, F005	1981 - Present	1
1002**	Tank	c	10.5' dia x 18' ht	S02	11,000	G	d	F003	1986-Present	1

APPURTENANT EQUIPMENT IN AND ASSOCIATED WITH RCRA UNIT B - RECLAIM CRUDE STORAGE TANK FARM:

1. Pumps
   a. Crude charge pumps (2), used for charging crude from Unit B to reclaim Area D (solvent recovery stills).
   b. Waste unloading pump at unloading ramp #1, used for unloading waste (crude) from tanker trucks for storage in Unit B tanks.
   c. Waste unloading pump at unloading ramp #2, indicated in Figure 4, was never installed.
   d. Boiler fuel pump for transfer of hazardous waste derived fuel from tank 1002 to boiler.
2. Filters
   a. Filter at unloading ramp #2, used to filter solids from waste (crude) unloaded from tanker trucks, prior to storage in Unit B tanks.
   b. Filter at unloading ramp #2, indicated in Figure 4, was never installed.
3. Piping*
   a. Piping for charging crude from Unit B to solvent recovery stills in Unit D, 2" dia x 500' in total length.
   b. Piping for transfer of crude from Unit B tanks to crude charge pumps, 2" dia x 800' in total length.
   c. Piping for transfer of crude from unloading pump at unloading ramp #1 to storage in Unit B tanks, 2" dia x 400' in total length, 3" Dia x 150' in total length.
   d. Piping for transfer of hazardous waste derived fuel from tank 1002 to boiler.

*Piping is schedule 40 iron and includes gate valves and fittings (unions, elbows, tees, nipples, bushings, caps, plugs, etc.).

**Tank 1002 is physically separate from the Unit B Reclaim Crude Tank Farm, but is inspected together with this unit during routine operations.

TABLE 1 (continued)
UNIT C INJECTANT STORAGE TANK FARM
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

Tank Number	Description			Process Code	Capacity (gallons)	Unit of Measure Code	Chemical Name(s)	Waste Code(s)	Period of Use	Reference Line on Part A
	Item	Tank Type	Dimensions (feet)							
202	Tank	c	10.5' dia x 29' ht	SO2	18,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
203	Tank	c	10.5' dia x 27' ht	SO2	16,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
204	Tank	c	10.5' dia x 27' ht	SO2	17,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
205	Tank	c	10.5' dia x 29' ht	SO2	18,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
206	Tank	c	10.5' dia x 27' ht	SO2	17,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
210	Tank	c	12' dia x 27.3' ht	SO2	23,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
211	Tank	c	12' dia x 27.3' ht	SO2	23,000	G	c	D001, F001, F002, F003, F005	1977 - Present	1
212	Tank	c	12' dia x 29' ht	SO2	24,000	G	c	D001, F001, F002, F003, F005	1981 - Present	1

APPURTENANT EQUIPMENT IN AND ASSOCIATED WITH RCRA UNIT C - INJECTANT STORAGE TANK FARM:

1. Pumps
   a. Waste unloading pumps (2) for unloading waste from tank trucks into Unit C tank storage.
   b. Injectant transfer pump for transfer of injectant between tanks in Unit C.
   c. Injectant loading pump for transfer of injectant to railroad tank cars located at south railroad siding.
2. Particle Size Reducer
   a. Gorator for particle size reduction of injectant stored in Unit C.
3. Piping*
   a. Piping for transfer of injectant from the loading pump to railroad tank cars located at south railroad siding, 3" dia x 600" total length.
   b. Piping between injectant storage tanks and loading pump, 3" dia x 150' in total length, 2" dia x 250' in length.
   c. Piping from injectant unloading pumps (2) to injectant storage tanks in Unit C, 3" dia x 150' total length, 2" dia x 100' total length.
4. Filters
   a. Filters (4), located at unloading ramp #3, used for filtering injectant as it is unloaded.
   b. Filter for injectant pre-load.
   c. Filters (2), basket type, for injectant loading.

*Piping is schedule 40 iron and includes gate valves and fittings (unions, elbows, tees, nipples, bushings, caps, plugs, etc.).

TABLE 1 (concluded)
UNIT D SOLVENT RECLAMATION FACILITY AND APPURTENANT EQUIPMENT
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

Still Number	Description	Process Code	Capacity (gallons)	Unit of Measure Code	Chemical Name(s)	Waste Code(s)	Period of Use	Reference Line on Part A
1	Solvent recovery still, 6' dia x 28' ht, on legs	TO4	5,500	G	e	D001, F001, F002,F003, F005	1977 - Present	2
2	Solvent recovery still, 6' dia x 28' ht, on legs	TO4	5,500	G	e	D001, F001, F002,F003, F005	1977 - Present	2
3	Solvent recovery still, 5' dia x 24' ht, on legs	TO4	3,500	G	e	D001, F001, F002,F003, F005	1977 - Present	2
7	Solvent recovery still, 7.5' dia x 24' l, on saddles	TO4	5,500	G	e	D001, F001, F002,F003, F005	1981 - Present	2

APPURTENANT EQUIPMENT IN AND ASSOCIATED WITH RCRA UNIT D - SOLVENT RECLAMATION FACILITY:

1. Pumps
   a. Residue pump used for transfer of distillate residues to tank storage in Unit C.
   b. #1 still recirculation pump used for circulating crude material during distillation inside solvent recovery still #1.
   c. #2 still recirculation pump used for circulating crude material during distillation inside solvent recovery still #2.
   d. #3 still recirculation pump used for circulating crude material during distillation inside solvent recovery still #3.
2. Heat Exchangers
   a. #1, #2 and #3 stills are equipped with heat exchangers on their respective recirculation systems.
3. Piping*
   a. Piping transfer of distillate residue from solvent reclaim facility (Unit D) to tank storage in Unit C, 3" dia x 500' total length.
   b. Piping for transfer of hazardous waste derived fuel from Unit D to tank 1002, 2" dia x 200' total length.
   c. Piping for recirculation within solvent recovery stills, 3" dia x 200' total length.

*Piping is schedule 40 iron and includes gate valves and fittings (unions, elbows, tees, nipples, bushings, caps, plugs, etc.).

TABLE 2
INVENTORY OF HAZARDOUS WASTE
CURRENTLY ON SITE

Description	*Volume*
1. Hazardous Waste Derived Fuel	
a. Industrial boiler fuel	10,000 gallons
b. Chem fuel (liquid)	10,000 gallons
c. Chem fuel (solid)	350 6-gallon pails
d. Kiln Fuel (solid)	10 55-gallon drums
2. Miscellaneous Hazardous Wastes	
a. General maintenance and "housekeeping" solids (soil and sand)	10 yd^3
b. Equipment scrap (solid)	15 yd^3

TABLE 3
SCHEDULE OF CLOSURE ACTIVITIES

Activity	*Elapsed Time (Days)*
IDEM approval of closure plan received by American Chemical Service	0
Initiate removal of waste inventory for off-site treatment/disposal and initiate burning of waste-derived fuel in on-site industrial boiler*	14
Initiate tank, vessel, container storage area and appurtenant equipment decontamination*	28
Complete removal and treatment/disposal of hazardous wastes*	90
Complete tank, vessel, container storage area and appurtenant equipment decontamination*	160
Final facility inspection by professional engineer*	180
Professional engineer certifies closure	240

* Indicates that the independent engineer or his qualified representative will be periodically present at the facility.

TABLE 4
CLOSURE COST ESTIMATE

I. Decontamination Costs:

A. Tanks and Vessels:

1) Site Preparations Prior to Waste Removal:

a) 27 Tanks and Vessels @ 2 hrs/unit = 54 manhours	$ 3,024.00
b) Materials @ $50.00/unit =	$ 1,350.00

2) Removal of Waste and Waste Residues Inside Tanks and Vessels:

a) 27 Tanks and Vessels @ 8 hrs/unit = 216 manhours =	$ 12,096.00
b) Packaging Waste Removed @ 1 hr/unit = 27 manhours =	$ 1,458.00
c) Materials @ $25.00/unit =	$ 675.00

3) Post Decontamination Inspection:

27 Tank and Vessels @ $100/unit =	$ 2,700.00
Subtotal:	$ 21,303.00

B. Container Storage Area and Concrete Surfaces:

1) Scraping Concrete Surfaces = 40 manhours =	$ 2,240.00
2) Packaging Scraped Solids = 4 manhours =	$ 224.00
3) Sandblasting Concrete Surfaces = 40 hours = (Note - Only surfaces which require sandblasting decontamination as specified by the professional engineer.)	$ 4,800.00
4) Portable Sandblasting Barrier =	$ 1,000.00
5) Packaging Sand From Sandblasting = 20 manhours =	$ 1,120.00
6) Post Decontamination Inspection	$ 400.00
Subtotal	$ 9,784.00

C. Pipes, Pumps, Filters & Etc.:

1) Pipe Disassembly and Swabbing = 30 manhours	$ 4,480.00
2) Pipe Decontamination Materials =	$ 500.00
3) Packaging Solids Residues From Piping = 8 manhours	$ 448.00
4) Pump Disassembly and Cleaning - 16 units @ 4 mahours per unit = 64 manhours	$ 3,584.00
5) Pump Decontamination Materials =	$ 200.00
6) Packaging Solids Residues From Pumps = 4 manhours	$ 224.00
7) Filters Disassembly and Cleaning - 10 units @ 2 manhours per unit = 20 manhours	$ 1,120.00
8) Filters Decontamination Materials =	$ 200.00
9) Packaging Solids Residues From Filters - 4 manhours	$ 224.00
10) Gorator Disassembly and Cleaning - 4 manhours	$ 224.00
11) Gorator Decontamination Materials =	$ 50.00

12) Packaging Solids Residues From Gorator = (1 manhour) =	$ 56.00
13) Heat Exchanger Disassembly and Cleaning - 3 units @ 4 manhours per unit = 12 manhours =	$ 672.00
14) Heat Exchanger Decontamination Materials	$ 200.00
15) Packaging Solids Residues From Heat Exchangers = 4 mahours =	$ 224.00
16) Miscellaneous Equipment Cleaning = 10 manhours	$ 560.00
17) Miscellaneous Equipment Decontamination Materials =	$ 200.00
18) Packaging Solids Residues From Miscellaneous Equipment = 4 manhours =	$ 224.00
19) Post Decontamination Inspection:	
a) Piping	$ 1,000.00
b) Pumps	$ 300.00
c) Filters	$ 500.00
d) Gorator	$ 100.00
e) Heat Exchangers	$ 300.00
f) Miscellaneous Equipment	$ 1,000.00
Subtotal	$ 16,790.00

II. Hazardous Waste Inventory Disposal Costs

A. Hazardous Waste Derived Fuel:

1) Distillate Boiler Fuel (liquid) - 10,000 gals	$ 2,500.00
2) Chem Fuel (liquid) - 10,000 gals	$ 2,500.00
3) Chem Fuel (solid) - 350 pails	$ 5,950.00
4) Kiln Fuel (solid) - 10 drums	$ 3,000.00

B. Miscellaneous Hazardous Wastes:

1) Housekeeping Solids - (soil and sand) - 10 yards	$ 4,000.00
2) Equipment Scrap (solid) - 15 yards	$ 6,000.00
Subtotal	$ 23,950.00

III. Other Costs

A. Professional Engineer's Certification	$ 5,000.00
B. Closure Plan Preparation	$ 30,000.00
Subtotal	$ 35,000.00
TOTAL:	$106,827.00
Contingency (10%)	$ 10,682.70
Grand Total	$117,509.70

CLOSURE COST ASSUMPTIONS

A. Waste Solids and Residues Remaining in the Tanks, Vessles, Concrete Surfaces, Pipes, Pumps, Filters and etc. Total the Following:

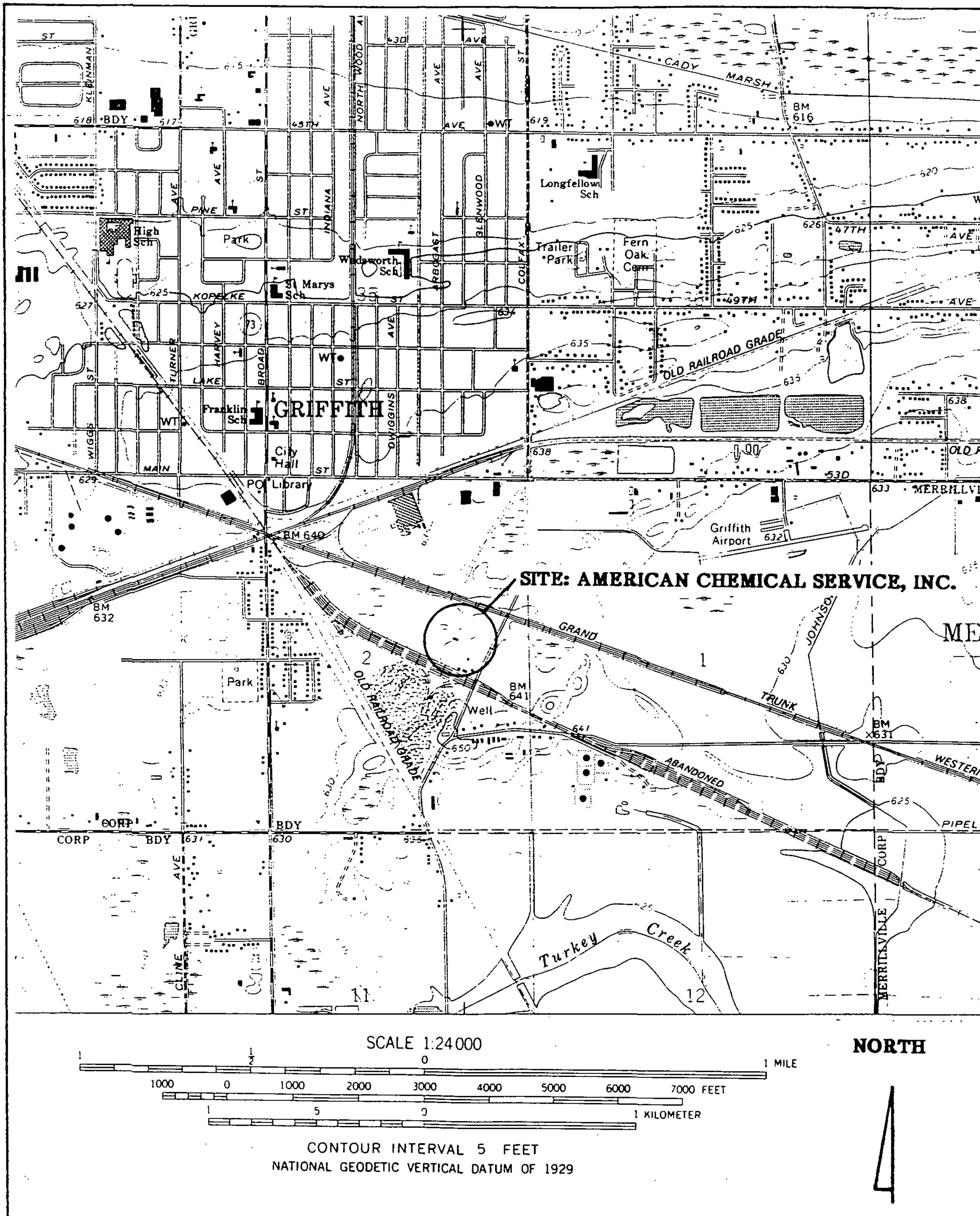
	Volume	Disposal Cost
1.	350 Pails (Chem Fuel Solid)	$ 5,950.00
2.	10 Drums (Kiln Fuel Solid)	$ 3,000.00
3.	10 Yards (Soil and Sand)	$ 4,000.00
4.	15 Yards (Equipment Scrap)	$ 6,000.00

B. Labor costs will be $14.00 per hour with an overhead factor of 300%. The rate will be $56.00 per hour for ACS facility personnel to perform closure activities. This rate can also be applied to outside contractors in the event ACS personnel are not available.

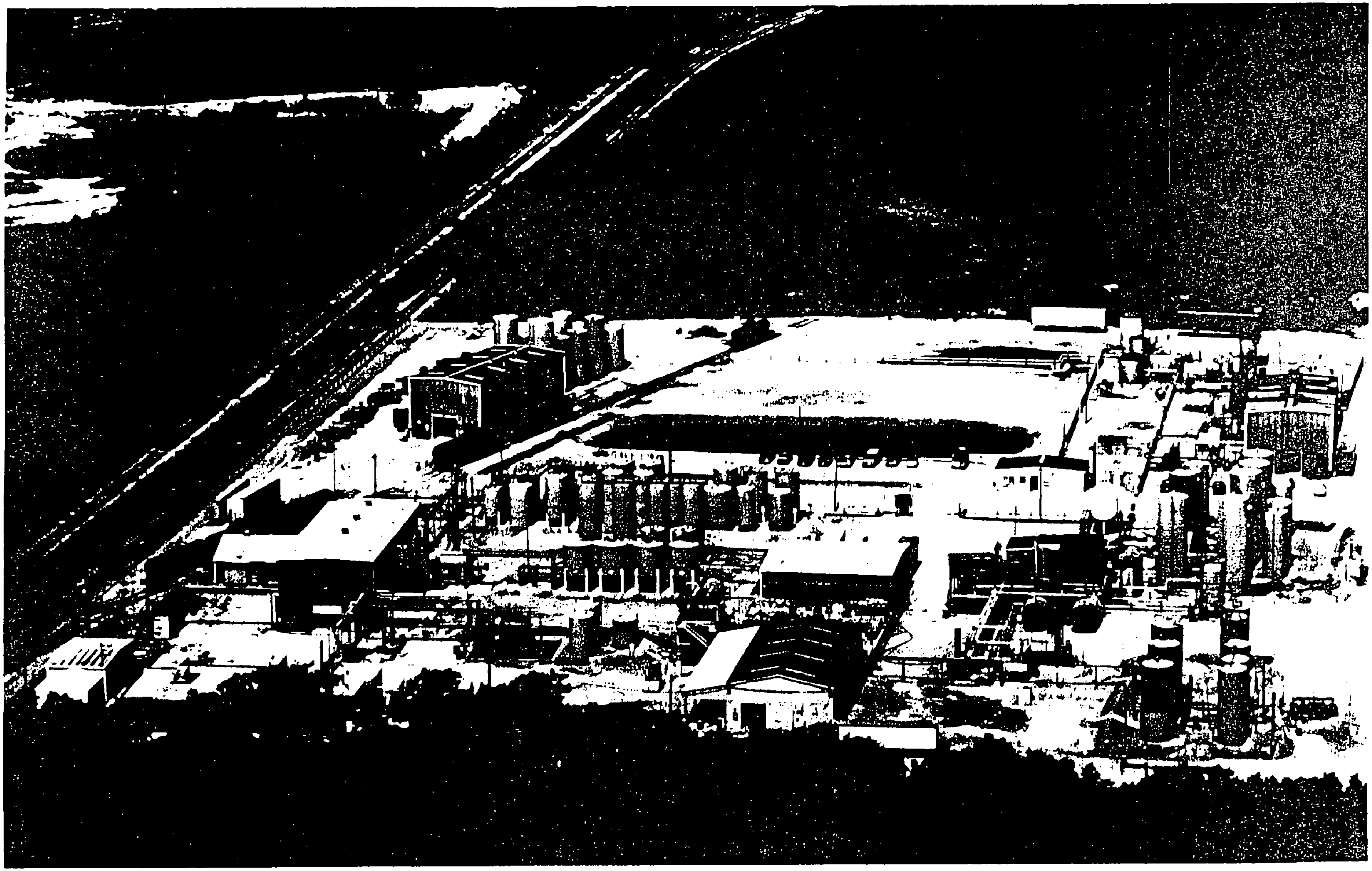
C. Sandblasting costs including personnel amounts to $120.00 per hour.

D. Labor costs for independent inspections and professional engineer certification are based on Baker/TSA 1991 labor rates.

FIGURES



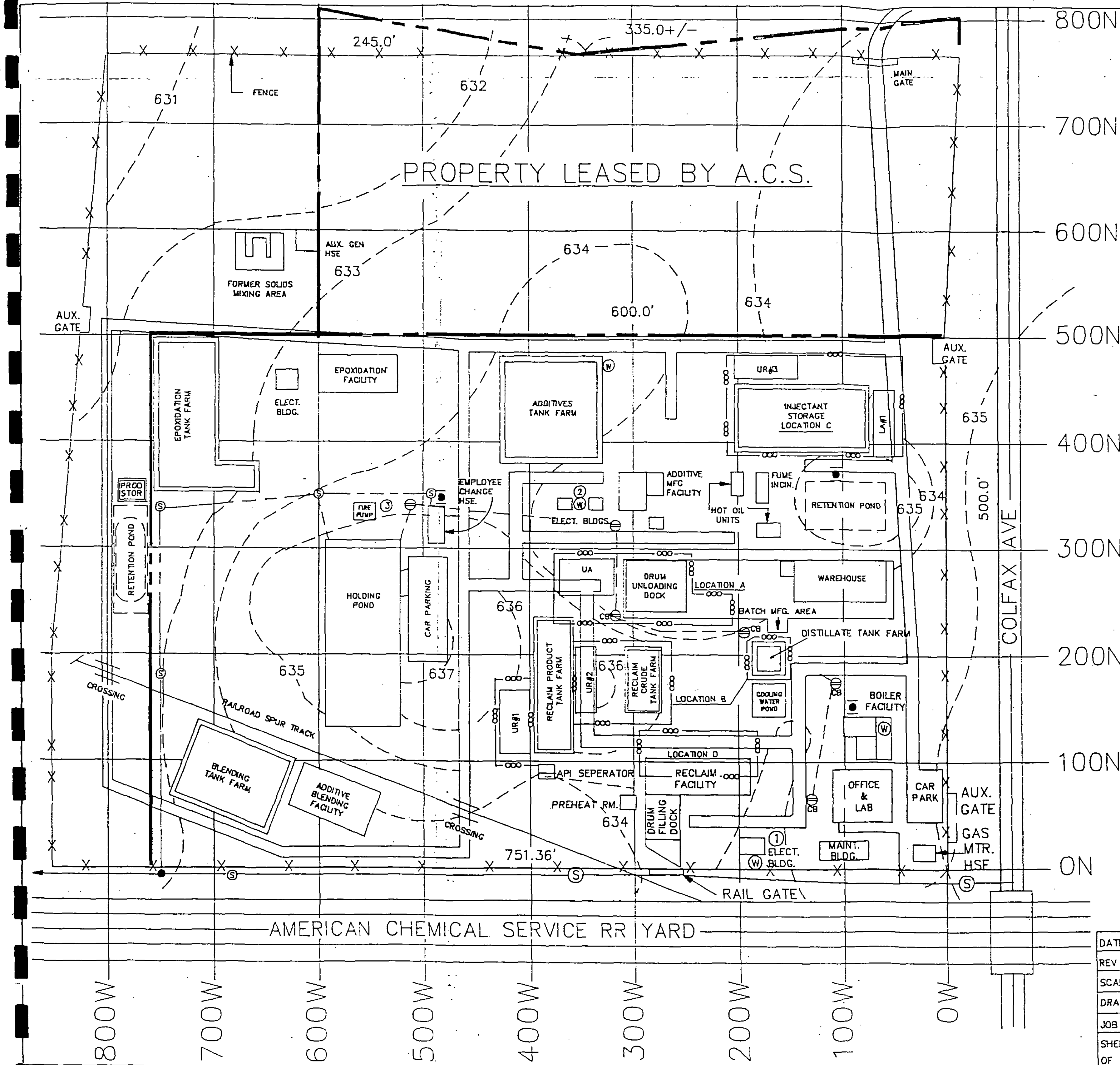
HIGHLAND, IND. 41087-E4-TF-024 1968 PHOTOREVISED 1986 DMA 3567 III SW–SERIES V851	**FIGURE 1** **REGIONAL SITE LOCATION** **AMERICAN CHEMICAL SERVICE, INC.** **GRIFFITH, INDIANA**	Baker Engineers™ Baker/TSA, Inc.



NOTE: Aerial photograph taken summer, 1989.

FIGURE 2
AERIAL OVERVIEW OF
AMERICAN CHEMICAL SERVICE, INC.
GRIFFITH, INDIANA

[redacted]ker[redacted], In[redacted]



NOTES:

1. SITE PLAN DESCRIPTION: THAT CERTAIN TRACT OR PARCEL OF LAND TOGETHER WITH THE IMPROVEMENTS LOCATED THEREON, WITH THE PRIVILEGES AND APPURTENANCES THEREUNTO BELONGING AND APPERTAINING AT GRIFFITH, LAKE COUNTY, INDIANA, BEING THE SAME SURVEY AFFIXED THERETO, DATED OCTOBER 10, 1967 AND RECORDED OCTOBER 30, 1967, IN DEED RECORD 1359, PAGES 261,262,263 AND 264 IN THE RECORDER'S OFFICE OF LAKE COUNTY, INDIANA, MADE BY THE CHESAPEAKE AND OHIO RAILWAY COMPANY, A VIRGINIA CORPORATION, TO AMERICAN CHEMICAL SERVICE, INC., SAID REAL ESTATE BEING MORE PARTICULARLY DESCRIBED AS FOLLOWS: PART OF SECTION 2, TOWNSHIP 35 NORTH, RANGE 9 WEST OF THE SECOND PRINCIPAL MERIDIAN, DESCRIBED AS BEGINNING AT A POINT 85 FEET NORTHEASTERLY AT RIGHT ANGLES FROM CENTERLINE OF MAIN TRACK OF WABASH SUBDIVISION OF THE CHESAPEAKE AND OHIO RAILWAY AT STATION 7944 + 56, SAID POINT ALSO BEING IN THE WESTERLY LINE OF COLFAX AVENUE; THENCE NORTH 64 53' 30" WEST PARALLEL WITH AND 85' FROM SAID CENTERLINE OF MAIN TRACK 761.36 FEET TO A POINT OPPOSITE STATION 7925 + 17.36; THENCE NORTH 25 06' 30" EAST AT RIGHT ANGLES FROM SAID CENTERLINE OF MAIN TRACK 500 FEET TO A POINT; THENCE SOUTH 64 53' 30" EAST PARALLEL WITH AND 585 FEET FROM SAID CENTERLINE OF MAIN TRACK 761.36 FEET TO A POINT IN THE SAID WESTERLY LINE OF COLFAX AVENUE OPPOSITE STATION 7944 + 56; THENCE SOUTH 25 06' 30" WEST ON SAID WESTERLY LINE OF COLFAX AVENUE, AT RIGHT ANGLES TOWARD SAID CENTERLINE OF MAIN TRACK 500 FEET TO THE POINT OF BEGINNING AND CONTAINING 8.74, MORE OR LESS.
2. TANK FARMS, AS IDENTIFIED, HAVE PERIMETER EARTHEN DIKED WALLS APPROXIMATELY THREE FEET ABOVE THE SURROUNDING GRADE.
3. RETENTION PONDS, AS IDENTIFIED, ARE USED ONLY FOR HEAVY RAIN FALL, AFTER WHICH WATER IS PUMPED TO HOLDING POND. NO STANDING WATER IS ALLOWED.
4. CATCH BASINS (CB) OR YARD DRAINS FLOW INTO POND.
5. HOLDING POND AS SHOWN IS 190' X 70' X 10' DEEP, WITH THE CAPACITY OF APROXIMATELY 900,000 GALLONS.
6. TOPOGRAPHY, AS SHOWN, IS FROM ELEVATIONS FURNISHED BY OWNER.
7. NONE OF THE AREAS SHOWN IN DRAWINGS S1 AND S2 ARE IN FLOODPLAIN AS ESTABLISHED BY U.S. ARMY CORPS OF ENGINEERS AND AS POSTED IN THE TOWN HALL OF GRIFFITH, INDIANA.

LEGEND:

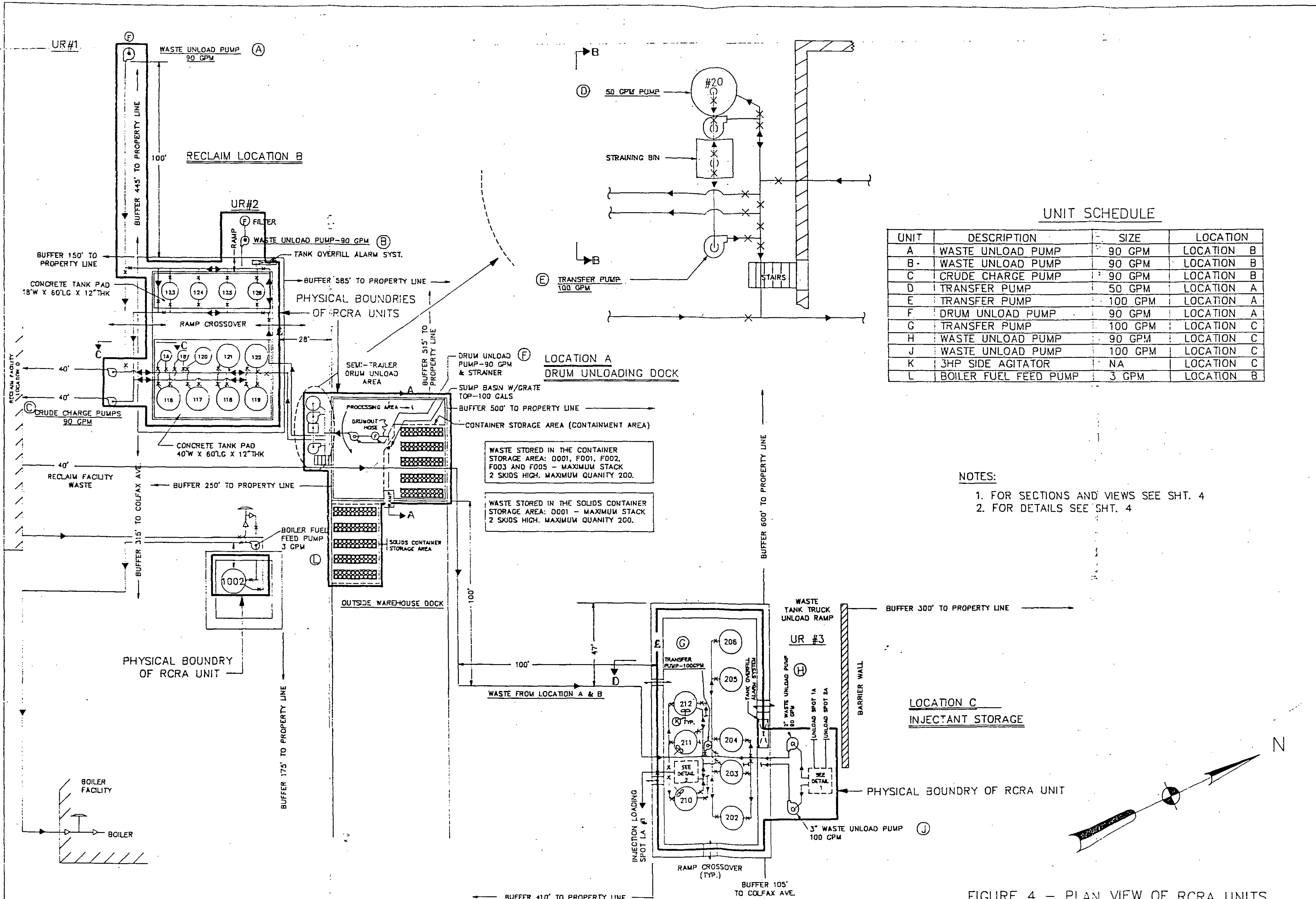
- (W) ON SITE WELLS – 4" CASING, 200 TO 300 FEET DEEP WITH 3 TO 5 HP SUBMERGED PUMP.
- ACCESS ROADS – MAIN GATE – KEYED CONTROLLED MOTORIZED GATE (AUTO CLOSING). ROAD BEDS – 6 TO 8" WITH FINE TO 1" GRAVEL #73
- (S) SANITARY SEWER – 12" V.C. PIPE WITH MAN HEADS AS NOTED.
- – – PROCESS SEWER LINES 4" TO 6" V.A.
- UR TANKER UNLOADING RAMP
- LA LOADING AREA
- UA UNLOADING AREA
- FIRE FIGHTING STATIONARY HOSE 6% FOAM UNITS
- (1) 1 1/2" LINE 200' RADIUS
- (2) 1 1/2" LINE 300' RADIUS
- (3) 2 1/2" LINE 350' RADIUS
- PORTABLE WHEEL DRY CHEMICAL (150#) NOTE: THERE ARE SIXTY 20# DRY CHEMICAL HAND EXTINGUISHERS LOCATED ON SITE
- —OOO— HAZARDOUS WASTE LOCATIONS (REFER TO DETAILED DRAWINGS)
- —X—X— FENCE LINE 6' HIGH CYCLONE FENCE W/3 STRANDED ARMS OF BARBED WIRE

FIGURE 3 – SITE MAP SHOWING FACILITY CONFIGURATION

DATE	10–15–86
REV #1	7/30/87
SCALE	1"=100'
DRAWN	T.N.
JOB	AC0005R2
SHEET 1 OF 4 SHEETS	

Micro-Ap
Micro-Application Services
2846 Vivian Street
Portage, Indiana 46368
(219) 762-5890

American Chemical Service Inc.
P.O. BOX 190 – GRIFFITH, IN 463[illegible]



UNIT SCHEDULE

UNIT	DESCRIPTION	SIZE	LOCATION
A	WASTE UNLOAD PUMP	90 GPM	LOCATION B
B	WASTE UNLOAD PUMP	90 GPM	LOCATION B
C	CRUDE CHARGE PUMP	90 GPM	LOCATION B
D	TRANSFER PUMP	50 GPM	LOCATION A
E	TRANSFER PUMP	100 GPM	LOCATION A
F	DRUM UNLOAD PUMP	90 GPM	LOCATION A
G	TRANSFER PUMP	100 GPM	LOCATION C
H	WASTE UNLOAD PUMP	90 GPM	LOCATION C
J	WASTE UNLOAD PUMP	100 GPM	LOCATION C
K	3HP SIDE AGITATOR	NA	LOCATION C
L	BOILER FUEL FEED PUMP	3 GPM	LOCATION B

NOTES:

1. FOR SECTIONS AND VIEWS SEE SHT. 4
2. FOR DETAILS SEE SHT. 4

FIGURE 4 – PLAN VIEW OF RCRA UNITS

REVISIONS | BY
RCRA UNIT DES 9/20/90 | TN

American Chemical Service Inc.
P.O. BOX 190 – GRIFFITH, IN 46319

Micro-Ap
Micro-Application Services

DATE 8/12/87
SCALE
DRAWN TN
JOB ACO1O2RO
SHEET 2 OF 4 SHEETS

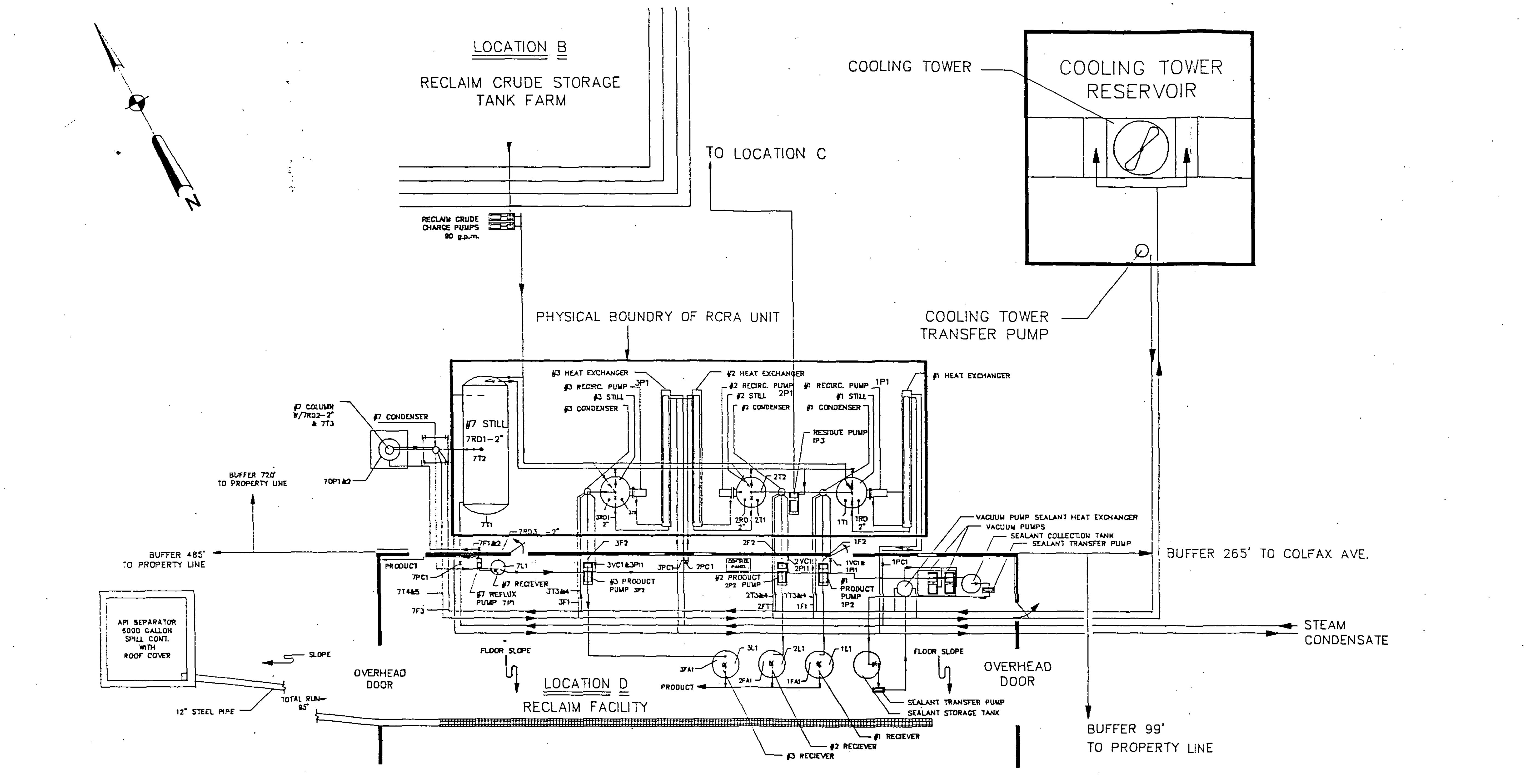


FIGURE 5 – PLAN VIEW OF RCRA UNIT D

DATE	10-20-86
SCALE	1"=20'
DRAWN	T.N.
JOB	AC0004R1
SHEET 3 OF 4 SHEETS	

Micro-Ap
Micro-Application Services
2846 Vivian Street
Portage, Indiana 46368
(219) 762-5890

ACS

American Chemical Service Inc.
P.O. BOX 190 – GRIFFITH, IN 46319

REVISIONS	BY
RCRA UNIT BOUNDRY ADDED 9/20/90	TN

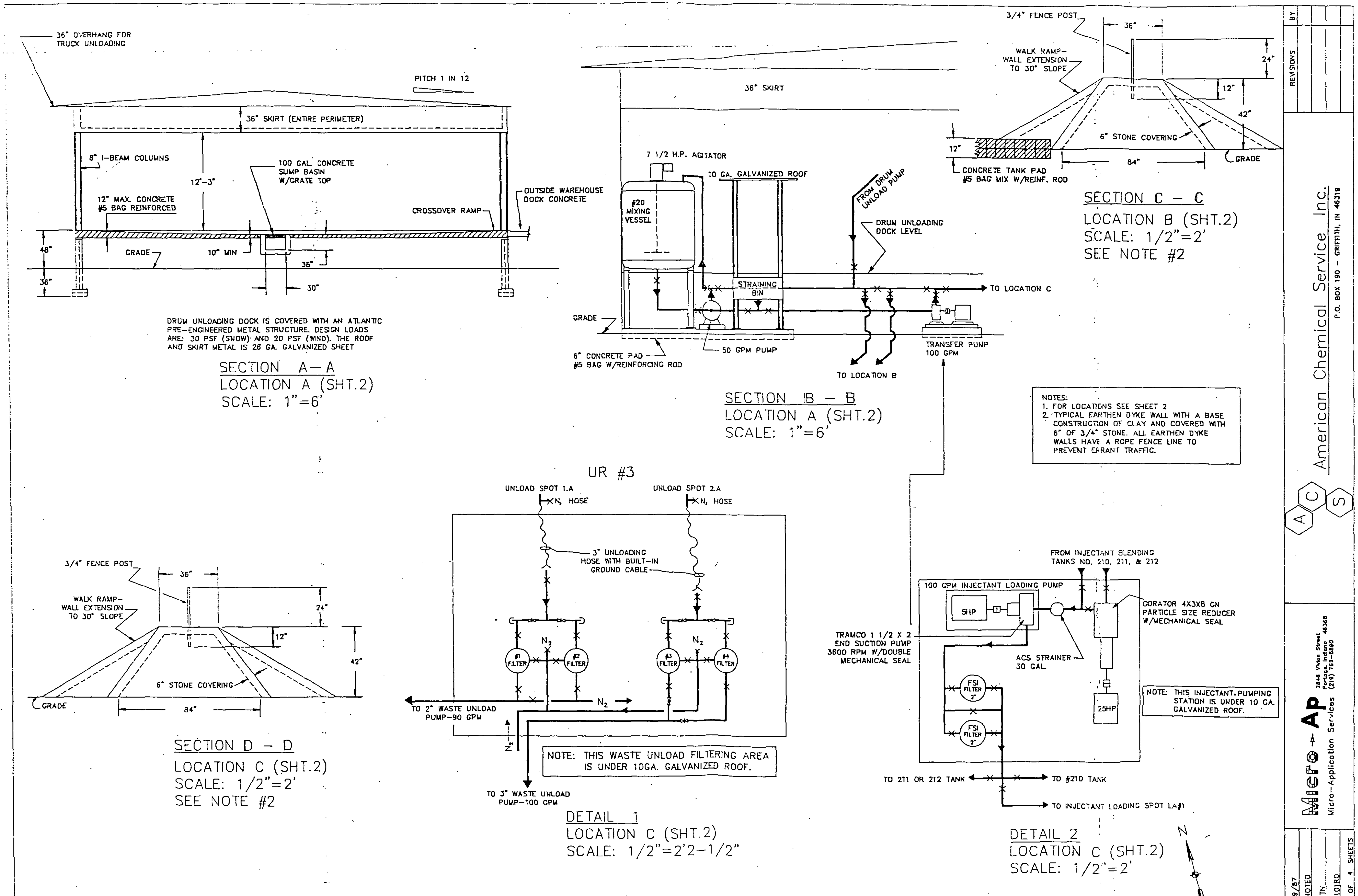
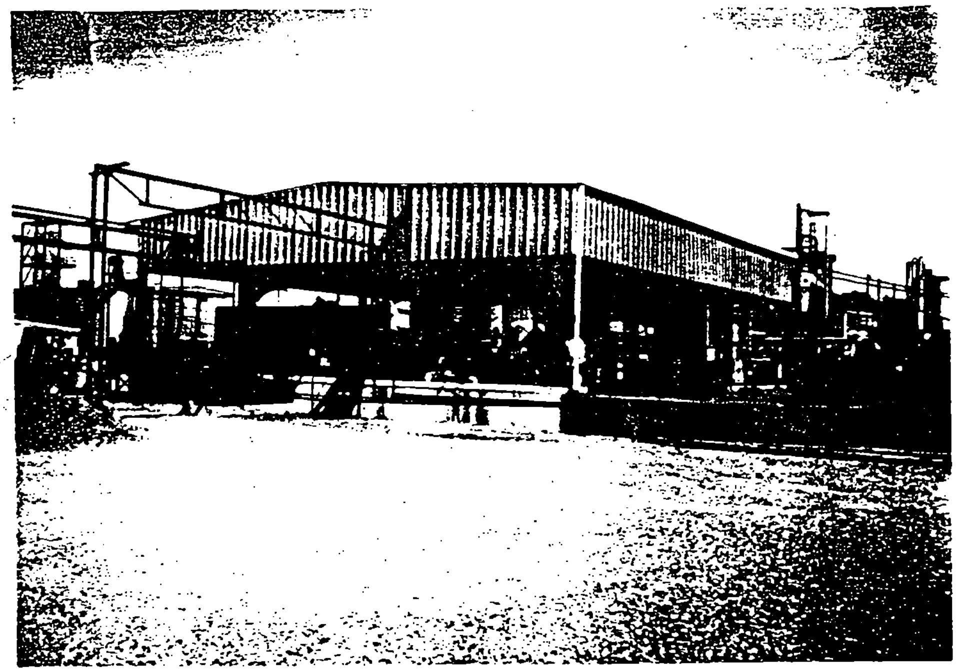
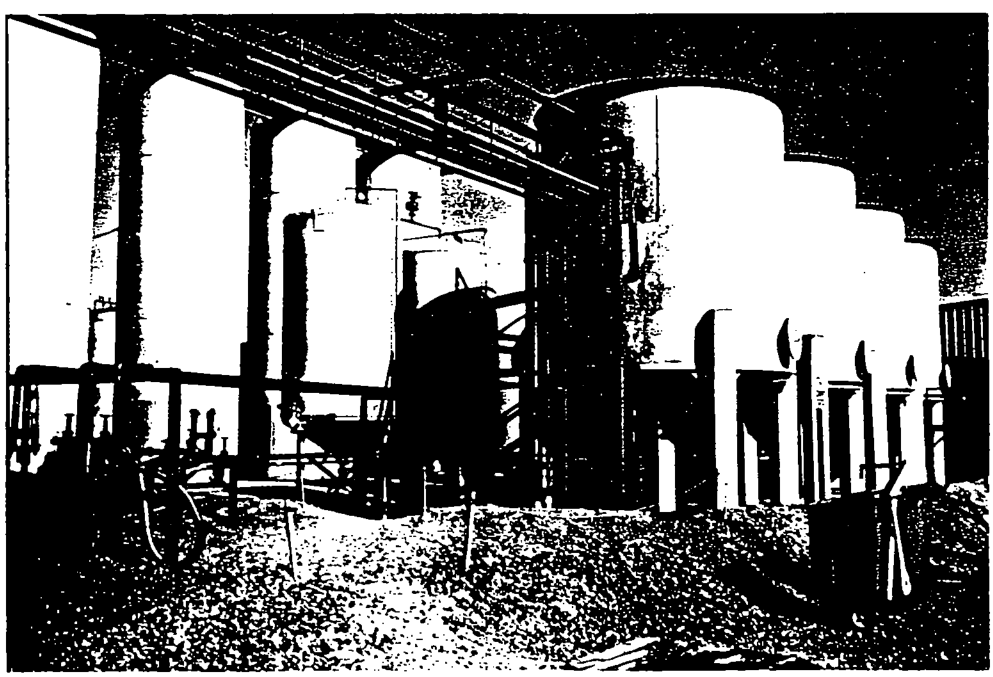


FIGURE 6 – RCRA UNIT CONSTRUCTION DETAILS

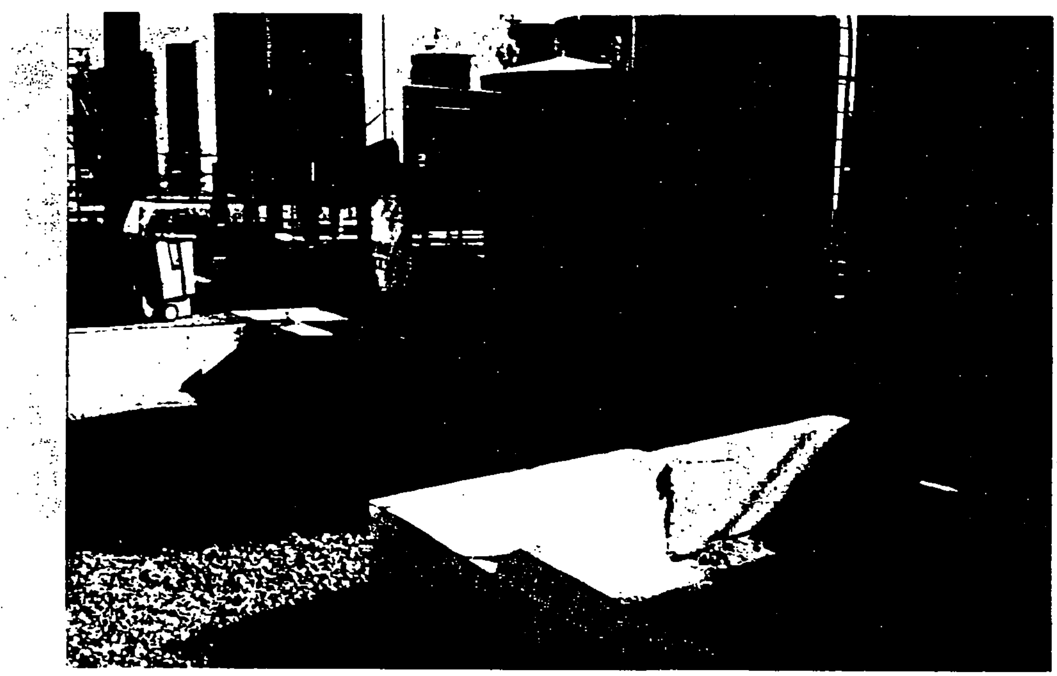


Unit A - Container Storage Area,
viewed from south.

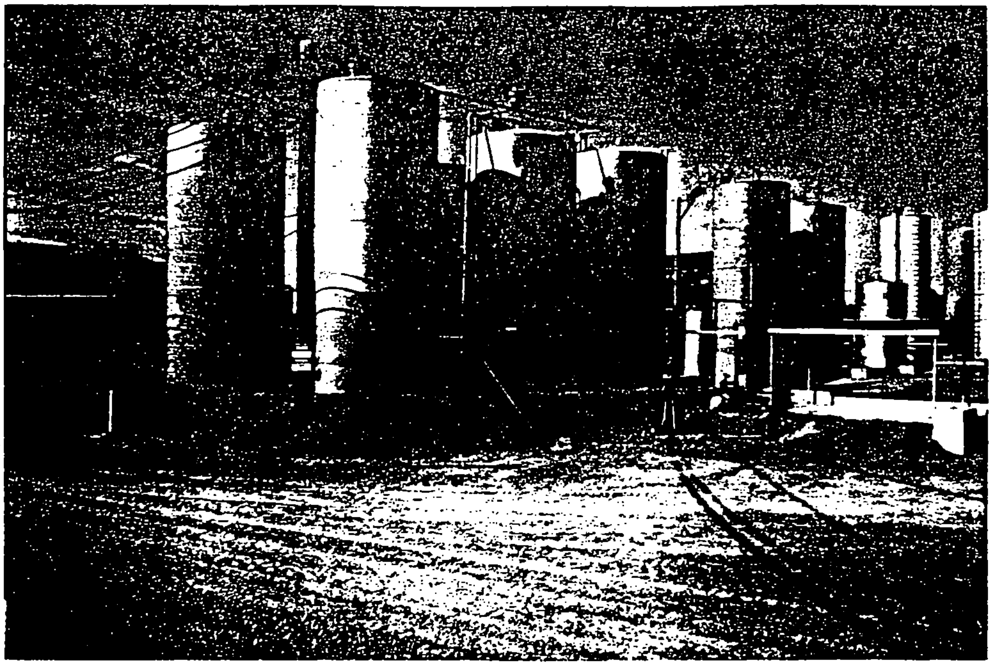


Unit B - Reclaim Crude Tank Farm,
viewed from south.

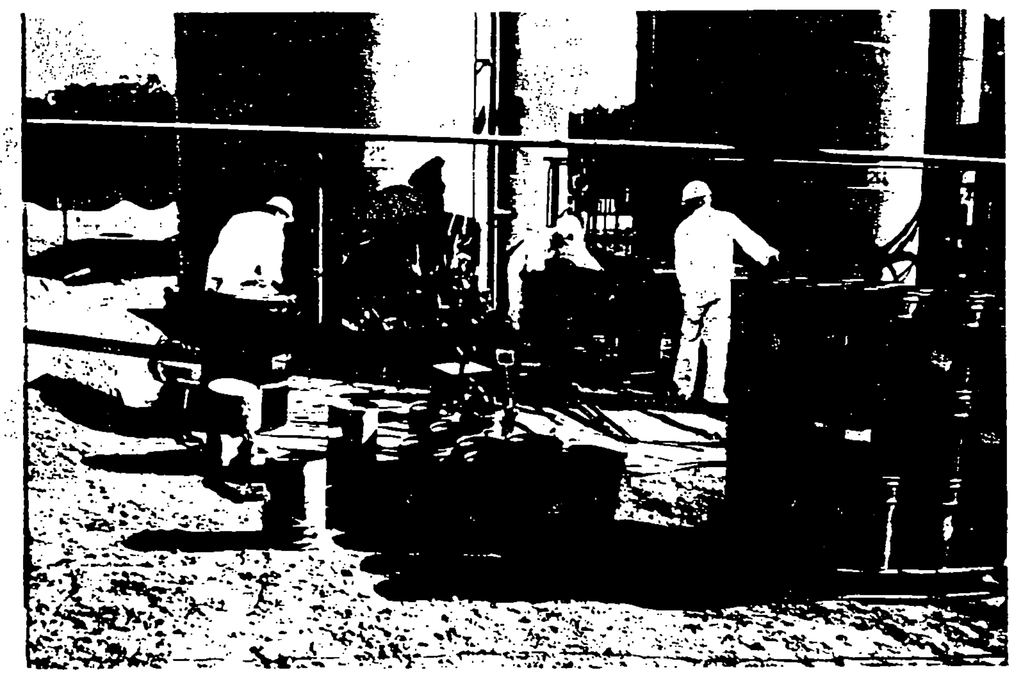
Unit B - Reclaim Crude Tank Farm,
viewed from north.



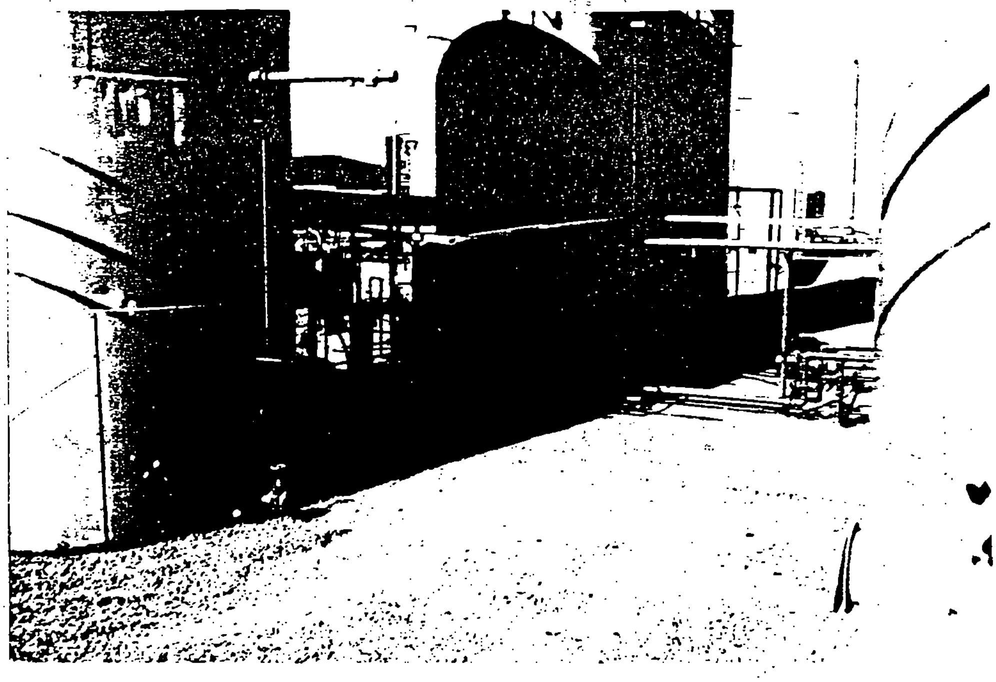
Unit B - Unloading Ramp #1



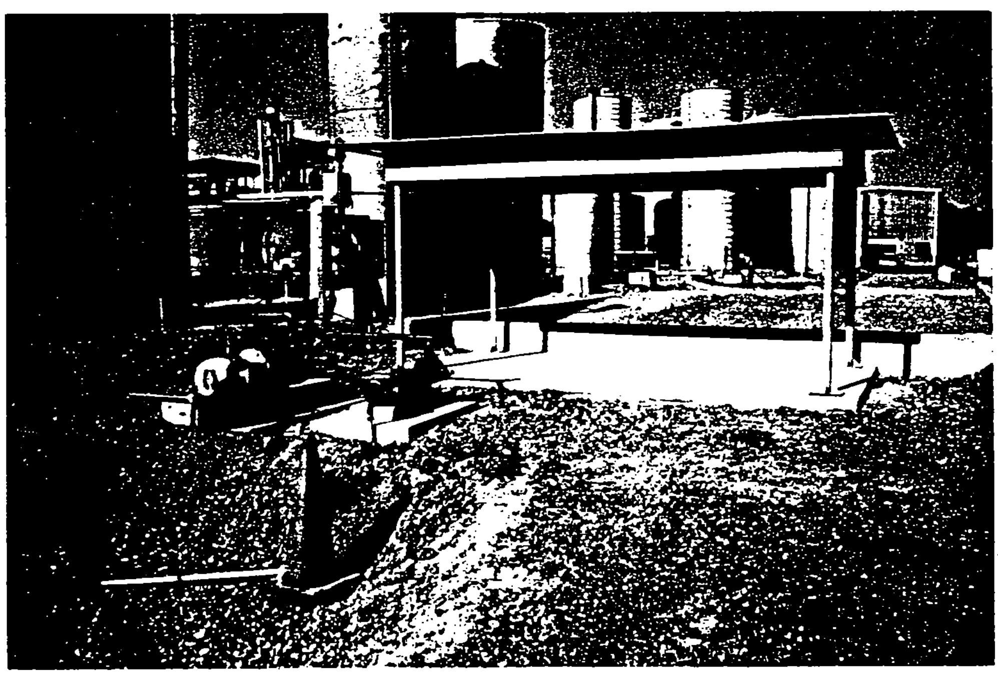
Unit C - Injectant Storage Tank Farm,
viewed from east.



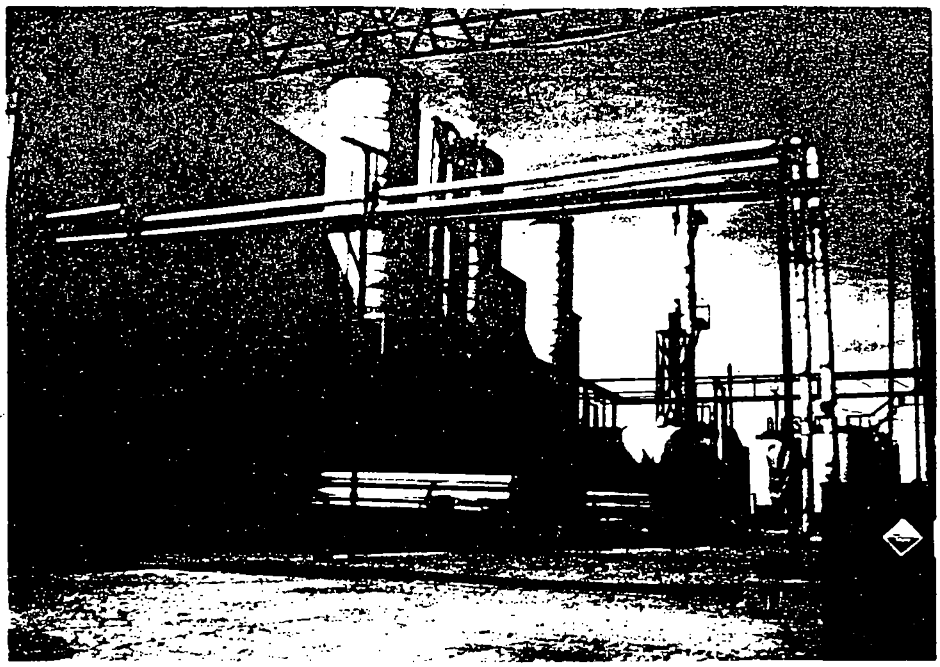
Unit B - Solids Inventory Removal From Tank 212.



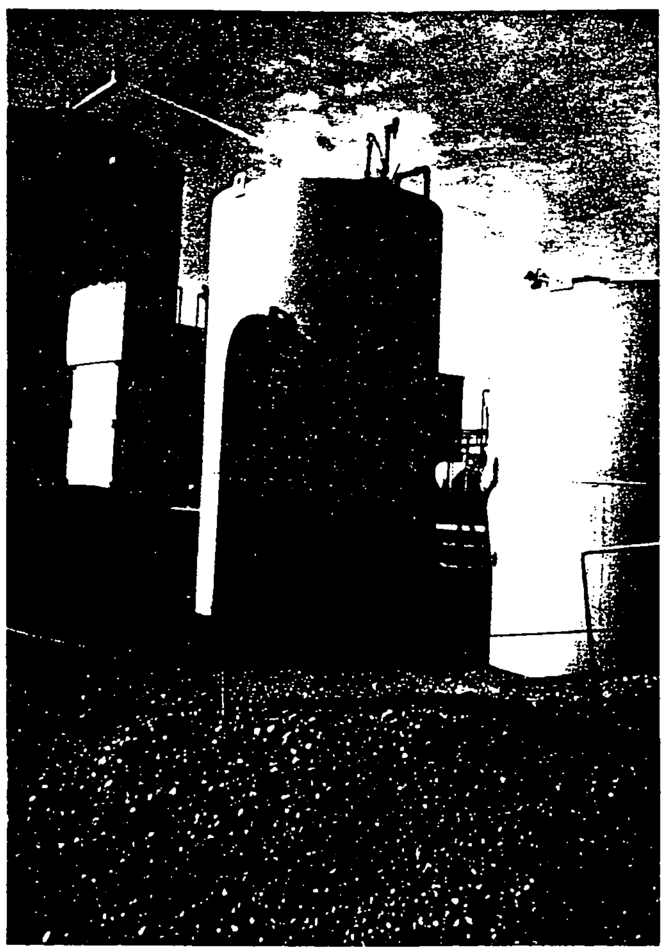
Unit C - Interior Area,
viewed from south.



Unit C - Unloading Ramp #3, from east.



Unit D - Reclaim Facility,
viewed from east.



Tank #1002 - Viewed from north.

APPENDIX A

1) ORIGINAL PART A PERMIT APPLICATION

2) OCTOBER 21, 1987 REVISION TO PART A PERMIT APPLICATION

3) DECEMBER 10, 1987 REVISION TO PART A PERMIT APPLICATION (CURRENTLY IN EFFECT)

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST.
CHICAGO, ILLINOIS 60604

(1.)

REPLY TO ATTENTION OF:

RCRA ACTIVITIES

FEB 11 1982

Mr. James Tarpo, President
American Chemical Service, Inc.
420 S. Colfax
Griffith, Indiana 46319

RE: Interim Status Acknowledgement USEPA ID No. IND016360265
FACILITY NAME: American Chemical Service, Inc.

Dear Mr. Tarpo:

This is to acknowledge that the U.S. Environmental Protection Agency (USEPA) has completed processing your Part A Hazardous Waste Permit Application. It is the opinion of this office that the information submitted is complete and that you, as an owner or operator of a hazardous waste management facility, have met the requirements of Section 3005(e) of the Resource Conservation and Recovery Act (RCRA) for Interim Status. However, should USEPA obtain information which indicates that your application was incomplete or inaccurate, you may be requested to provide further documentation of your claim for Interim Status. Our opinion will be reevaluated on the basis of this information.

As an owner or operator of a hazardous waste management facility, you are required to comply with the interim status standards as prescribed in 40 CFR Parts 122 and 265, or with State rules and regulations in those States which have been authorized under Section 3006 of RCRA. In addition, you are reminded that operating under interim status does not relieve you from the need to comply with all applicable State and local requirements.

The printout enclosed with this letter identifies the limit(s) of the process design capacities your facility may use during the interim status period. This information was obtained from your Part A Permit application. If you wish to handle new wastes, to change processes, to increase the design capacity of existing processes, or to change ownership or operational control of the facility, you may do so only as provided in 40 CFR Sections 122.22 and 122.23.

As stated in the first paragraph of this letter, you have met the requirements of 40 CFR Part 122.23; your facility may operate under interim status until such time as a permit is issued or denied. This will be preceded by a request from this office or the State (if authorized) for Part B of your application. Please contact Arthur Kawatachi of my staff at (312) 886-7449, if you have any questions concerning this letter or the enclosure.

Sincerely yours,

Karl J. Klepitsch Jr.

Karl J. Klepitsch, Jr., Chief
Waste Management Branch

Enclosure

FACILITY NAME

AMERICAN CHEMICAL SERVICE INC.

EPA ID NUMBER

IND016360265

FACILITY OPERATOR

AMERICAN CHEMICAL SERVICE INC.

FACILITY OWNER

AMERICAN CHEMICAL SERVICE INC.

FACILITY LOCATION

420 SO. COLFAX
GRIFFITH, IN 46319

PROCESS CODE	DESIGN CAPACITY	UNIT OF MEASURE
T04	50000.00000	U
S02	300000.00000	G

---------- KEY ----------

PROCESS	PRO-CESS CODE	APPROPRIATE UNITS OF MEASURE
STORAGE:		
CONTAINER	S01	G or L
TANK	S02	G or L
WASTE PILE	S03	Y or C
SURFACE IMPOUNDMENT	S04	G or L
DISPOSAL:		
INJECTION WELL	D79	G,L,U, or V
LANDFILL	D80	A or F
LAND APPLICATION	D81	B or Q
OCEAN DISPOSAL	D82	U or V
SURFACE IMPOUNDMENT	D83	G or L
TREATMENT:		
TANK	T01	U or V
SURFACE IMPOUNDMENT	T02	U or V
INCINERATOR	T03	D,W,E, or H
OTHER	T04	U,V,J,R,N, or S

UNIT OF MEASURE	CODE
GALLONS	G
LITERS	L
CUBIC YARDS	Y
CUBIC METERS	C
GALLONS PER DAY	U
LITERS PER DAY	V
TONS PER HOUR	D
METRIC TONS/HOUR	W
GALLONS/HOUR	E
LITERS/HOUR	H
ACRE-FEET	A
HECTARE-METER	F
ACRES	B
HECTARES	Q
POUNDS/HOUR	J
KILOGRAMS/HOUR	R
TONS PER DAY	N
METRIC TONS/DAY	S

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

FOR OFFICIAL USE ONLY

APPLICATION APPROVED | DATE RECEIVED (yr., mo., & day) | COMMENTS

I. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

2. NEW FACILITY *(Complete item below.)*

FOR EXISTING FACILITIES, PROVIDE THE DATE (yr., mo., & day) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

1. FACILITY HAS INTERIM STATUS

2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.

1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	
LITERS	L	TONS PER HOUR	D	HECTARE-METER	
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

DUP | T/A | C: 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S02	600	G		5				
X-2	T03	20	E		6				
1	S02	300,000	S		7				
2	T04	50,000	U		8				
3	S01	33000	G		9				
4					10				

... PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES (code "T04"). FOR EACH PROCESS ... INCLUDE DESIGN CAPACITY.

T04 REPRESENTS TOTAL SOLVENT & FUEL
BLENDING CAPACITY

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four–digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.

2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* — A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO *(enter code)*	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE *(enter code)*	D. PROCESSES 1. PROCESS CODES *(enter)*	D. PROCESSES 2. PROCESS DESCRIPTION *(if a code is not entered in D(1))*
X-1	K 0 5 4	900	P	T 0 3 D 8 0	
	D 0 0 2	400	P	T 0 3 D 8 0	
X-3	D 0 0 1	100	P	T 0 3 D 8 0	
X-4	D 0 0 2				included with above

FOR OFFICIAL USE ONLY

EPA I.D. NUMBER (enter from page 1): W [illegible] | 1 | W | DUP | 2 | DUP

V. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F017	X 1024	T	[illegible]	[illegible]			
2	F001	1420	[illegible]	[illegible]	[illegible]			
3	F002	354	[illegible]	[illegible]	[illegible]			
4	F003	16140	[illegible]	[illegible]	[illegible]			
5	F005	7348	[illegible]	[illegible]	T14			
6	K078	X 1880	T	S02	T04			
7	U002	1240	T	S02	T04			
8	U031	32	T	S02	T04			
9	[illegible]	20	T	S02	T04			
10	[illegible]	10	T	S02	T04			
11	[illegible]	20	T	S02	T04			
12	F017	X 40	T	S01	T04			
13	K078	X 42	T	S01	T04			
14	F001	25	T	S01	T04			
15	F002	25	T	S01	T04			
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

A. FIRST	B. SECOND
(specify) [illegible]	7 (specify) [illegible]

C. THIRD	D. FOURTH
(specify) [illegible]	7 (specify) [illegible]

VIII. OPERATOR INFORMATION

A. NAME: [illegible] CHEMICAL SERVICE INC

B. Is the name listed in Item VIII-A also the owner? ☒ YES ☐ NO

C. STATUS OF OPERATOR (Enter the appropriate letter into the answer box; if "Other", specify.)
F = FEDERAL, S = STATE, P = PRIVATE, M = PUBLIC (other than federal or state), O = OTHER (specify)
Answer: P (specify)

D. PHONE (area code & no.): A [illegible]

E. STREET OR P.O. BOX: PO BOX 190

F. CITY OR TOWN	G. STATE	H. ZIP CODE
GRIFFITH	IN	46319

IX. INDIAN LAND

Is the facility located on Indian lands? ☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES (Discharges to Surface Water)	D. PSD (Air Emissions from Proposed Sources)	
N	9 P	
B. UIC (Underground Injection of Fluids)	**E. OTHER (specify)**	
U	9 45018 20271	(specify) IN. OPERATING AIR [illegible]
C. RCRA (Hazardous Wastes)	**E. OTHER (specify)**	
	9 45018 20277	(specify) IN. OPERATING - AIR [illegible]

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS (provide a brief description)

SOLVENT RECLAMATION & WASTE DISPOSAL

CUSTOM CHEMICAL MANUFACTURING - FUEL ADDITIVES

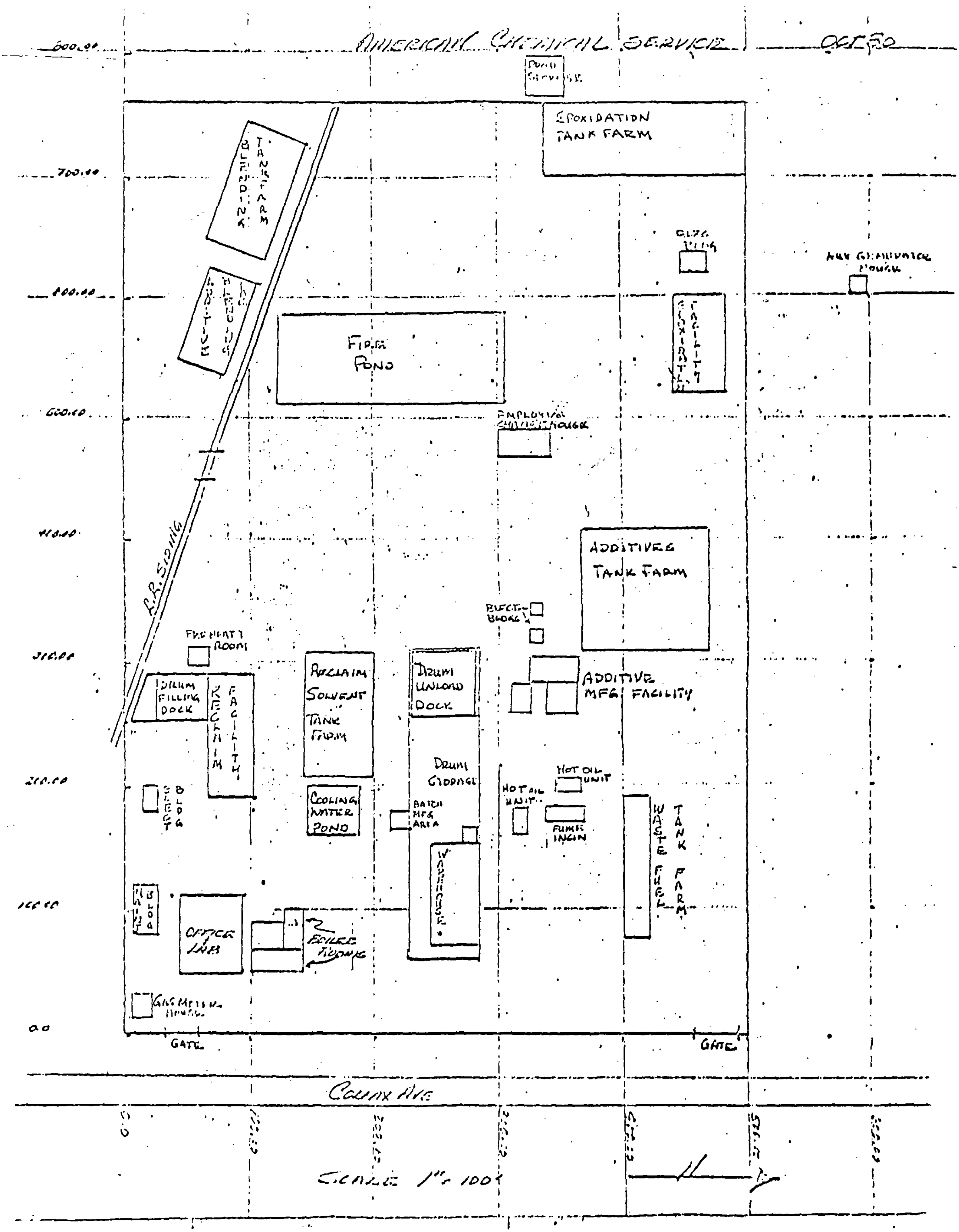
PLASTICIZERS & RESINS

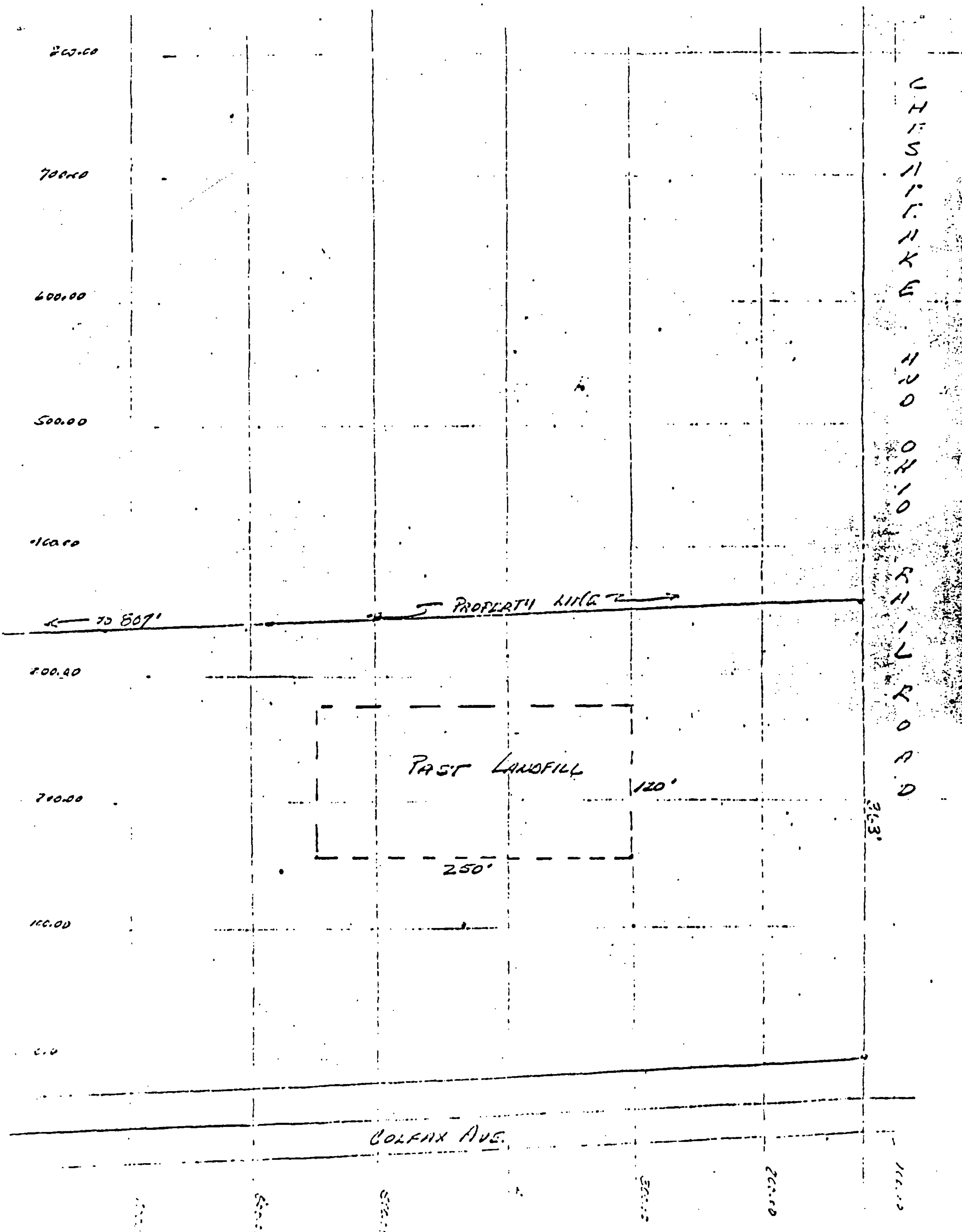
XIII. CERTIFICATION (see instructions)

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

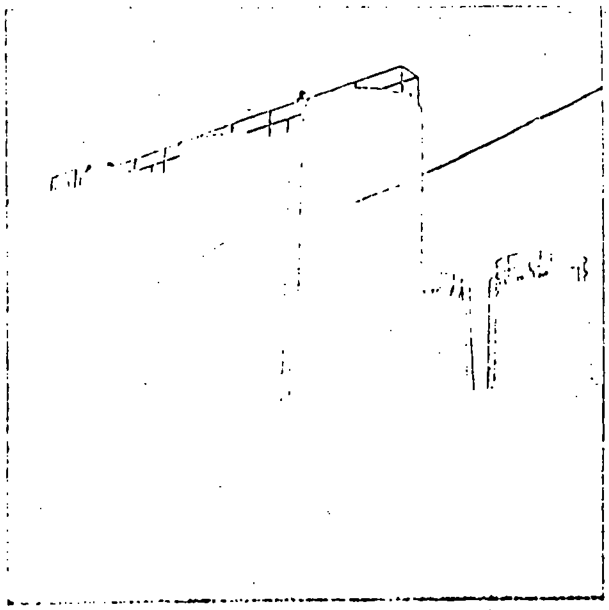
A. NAME & OFFICIAL TITLE (type or print)	B. SIGNATURE	C. DATE SIGNED
[illegible] PRESIDENT	[illegible]	11-4-80

COMMENTS FOR OFFICIAL USE ONLY

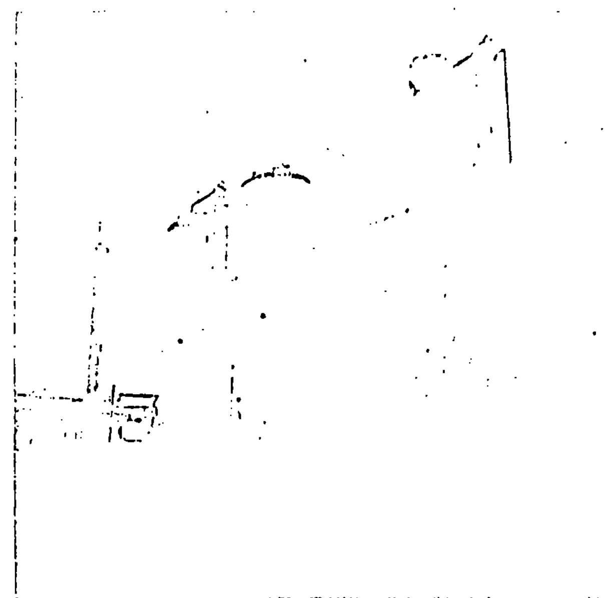

AMERICAN CHEMICAL SERVICE
OCT 80
EPOXIDATION TANK FARM
BLENDING TANK FARM
ADDITIVE BLENDING
FIRE POND
FACILITY
EMPLOYEE CHANGE HOUSE
ADDITIVES TANK FARM
R.R. SIDING
ELECT. BLDGS
FREEZE ROOM
DRUM FILLING DOCK
RECLAIM FACILITY
RECLAIM SOLVENT TANK FARM
DRUM UNLOAD DOCK
ADDITIVE MFG. FACILITY
DRUM STORAGE
HOT OIL UNIT
COOLING WATER POND
BATCH MFG AREA
FUME INCIN
WASTE FUEL TANK FARM
WAREHOUSE
OFFICE LAB
BOILER ROOMS
GAS METER HOUSE
GATE
GATE
COLFAX AVE
SCALE 1" = 100'
0.0
100.00
200.00
300.00
400.00
500.00
600.00
700.00
800.00



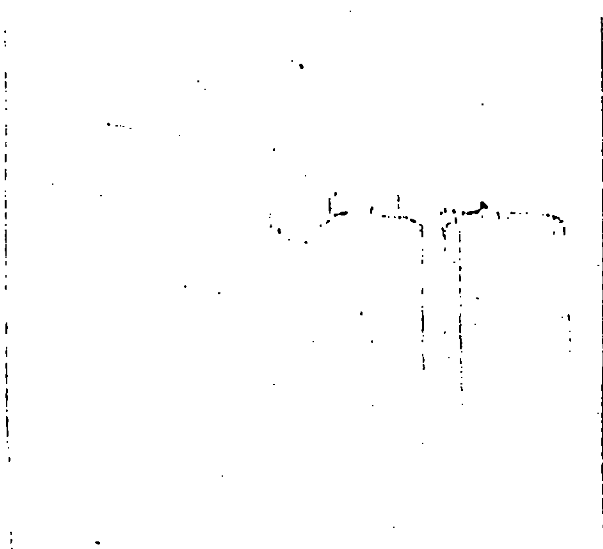
700.00
600.00
500.00
PROPERTY LINE
TO 807'
200.00
PAST LANDFILL
120'
250'
100.00
COLFAX AVE.
CHESAPEAKE AND OHIO RAILROAD



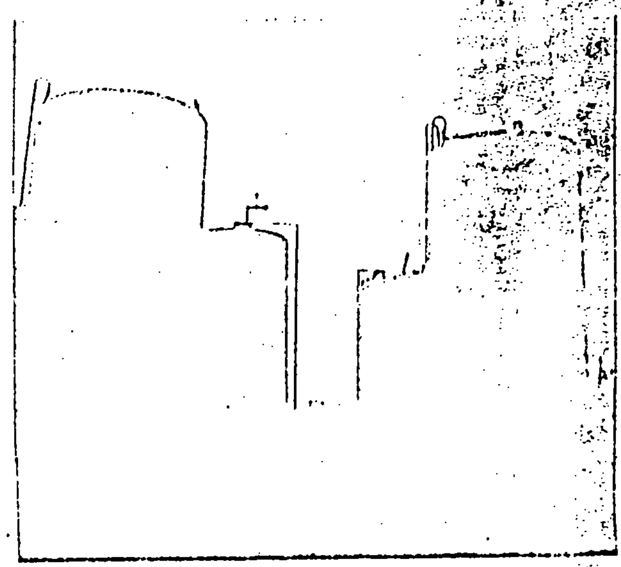
CRUDE & FINISHED
SOLVENT STORAGE
11-13-80



SOLVENT RECYCLING PLANT
11-13-80



CRUDE & FINISHED FUEL
STORAGE AREA
11-13-80



CRUDE & FINISHED FUEL
STORAGE AREA
11-13-80

2

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
NANCY A. MALOLEY, Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317-232-8603

October 21, 1987

Mr. James Tarpo
American Chemical Services, Inc.
P.O. Box 190
Griffith, Indiana 46319

Re: Letter of Compliance
Case Nos. (VL-021) and (V-205)
American Chemical Services, Inc.
EPA I.D. No. IND 016360265
Griffith, Lake County

Dear Mr. Tarpo:

Based upon documents available to the Office of Solid and Hazardous Waste Management staff during a record review on October 7, 1987, and an inspection conducted on September 15, 1987, it has been determined that American Chemical Services, Inc., has achieved compliance with the terms of the Violation Letter (VL-021) issued to your firm on June 5, 1987.

In regard to the Notice of Violation (V-205), the record review conducted also revealed that compliance has been achieved.

Thank you for your cooperation. If you have any questions concerning this matter, feel free to contact Mr. Michael E. Sickels of the Office of Solid and Hazardous Waste Management at AC 317/232-3406.

Sincerely,

Jane Magee

Jane Magee
Assistant Commissioner for
Solid and Hazardous Waste Management

MES/rmw

cc: Mr. Ted F. Warner
Mr. Lewis R. Schoenberger
Lake County Health Department
Ms. Sally K. Swanson, U.S. EPA, Region V

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
NANCY A. MALOLEY, Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317-232-8603

VIA CERTIFIED MAIL P 101 738 262

June 5, 1987

Mr. James Tarpo
American Chemical Services
P.O. Box 190
Griffith, IN 46319

Re: Hazardous Waste Management
Compliance Inspection
American Chemical Services
IND 016360265
Violation Letter (VL-012) and
Notice of Inadequacy (V-205)

Dear Mr. Tarpo:

Representatives of the Department of Environmental Management (Department) are conducting inspections of facilities in Indiana that are engaged in the generation, transportation, treatment, storage, or disposal of hazardous waste. Facilities are being inspected to determine compliance with Indiana Code, IC 13-7, the Environmental Management Act, and Indiana Administrative Code, 320 IAC 4.1, "Hazardous Waste Management Permit Program and Related Hazardous Waste Management Requirements." These inspections and record reviews are also being conducted pursuant to the requirements of the Resource Conservation and Recovery Act (RCRA), Public Law 94-580, as amended, for authorized state hazardous waste management programs.

This notice is to inform you that on February 2, 1987, and April 15, 1987, inspections of American Chemical Services, P.O. Box 190, Griffith, Indiana, were conducted by Mr. Lewis R. Schoenberger of the Office of Solid and Hazardous Waste Management, of the Department. You represented your firm at these inspections.

The following violations of RCRA and 320 IAC 4.1 pertaining to the operation of your facility were noted:

1. 320 IAC 4.1-7-2 Generator has improperly determined F003 and F005 hazardous waste to be D001 hazardous waste.

2. 320 IAC 4.1-8-2 Manifests do not contain a unique five-digit manifest document number.

3. 320 IAC 4.1-8-2 — Manifests do not contain the proper shipping name, hazard class, and identification number of the waste(s) as required by the U.S. Department of Transportation in 49 CFR 172.101, 172.202, and 172.203.

4. 320 IAC 4.1-16-6 — The inspection log does not contain a description of repairs or remedial actions.

5. 320 IAC 4.1-17-5 — Immediate access to internal alarm systems at the container storage area was not provided.

6. 320 IAC 4.1-23-4 — Containers are not stored closed. Three 55-gallon drums of hazardous waste were stored open.

7. 320 IAC 4.1-17-6 — Lack of adequate aisle space for the unobstructed movement of personnel and emergency equipment.

American Chemical Services, within thirty (30) calendar days of receipt of this notice, shall achieve compliance with the following requirements:

1. Fuels derived from listed hazardous wastes must be manifested with listed hazardous waste codes.

2. Submit a completed, corrected copy of the manifests.

3. Include a description of the nature of any remedial actions on the inspection log.

4. Provide immediate access to internal alarm systems at the container storage area.

5. Close all containers during storage.

6. Provide enough aisle space for the unobstructed movement of personnel and emergency equipment.

In regard to the Notice of Violation (V-205) issued September 24, 1985, and subsequent correspondence of January 30, 1986, and of March 6, 1986 (compliance date change), the following information is requested:

1. Are all container storage and handling areas used in processing hazardous waste fuel shown on the present Part A map and included in the Part A process codes and quantities?

2. Are all the storage and treatment tanks used in processing hazardous waste fuel shown on the present Part A map and included in the Part A process codes and quantities?

3. Does your present closure plan address all areas used to process hazardous waste fuel, including storage prior to shipment?

Your company shall submit to this office, within thirty-five (35) calendar days of receipt of this letter, a written detailed explanation of the steps taken to achieve compliance. The letter shall state the date compliance was achieved.

Failure to respond adequately to this Violation Letter and verify a return to compliance at this facility will result in escalated enforcement action.

Please direct your response to this notice and any questions to Mr. Michael E. Sickels, R.P.S., of the Office of Solid and Hazardous Waste Management, Department of Environmental Management, at AC 317/232-3406.

Very truly yours,

Bruce H Palin for
David D. Lamm
Assistant Commissioner for
Solid and Hazardous Waste Management

MES/rmw
cc: Lake County Health Department
Ms. Sally K. Swanson, U.S. EPA, Region V
Mr. Lewis R. Schoenberger

FORM 3 RCRA

EPA

U.S. ENVIRONMENTAL PROTECTION AGENCY
HAZARDOUS WASTE PERMIT APPLICATION
Consolidated Permits Program
(This information is required under Section 3005 of RCRA.)

I. EPA I.D. NUMBER: F I N D 0 1 6 3 6 0 2 6

FOR OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

2

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below (*mark one box only*) to indicate whether this is the first application you are submitting for your facility or a revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION (*place an "X" below and provide the appropriate date*)

☐ 1. EXISTING FACILITY (*See instructions for definition of "existing" facility. Complete item below.*)

☐ 2. NEW FACILITY (*Complete item below.*)

C 8 — YR. / MO. / DAY — FOR EXISTING FACILITIES, PROVIDE THE DATE (*yr., mo., & day*) OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED (*use the boxes to the left*)

YR. / MO. / DAY — FOR NEW FACILITIES, PROVIDE THE DATE (*yr., mo., & day*) OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION (*place an "X" below and complete Item I above*)

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. **PROCESS CODE** – Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(*s*) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process (*including its design capacity*) in the space provided on the form (*Item III-C*).

B. **PROCESS DESIGN CAPACITY** – For each code entered in column A enter the capacity of the process.
1. AMOUNT – Enter the amount.
2. UNIT OF MEASURE – For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

REVISED 10 JULY 87

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER (*barrel, drum, etc.*)	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET (*the volume that would cover one acre to a depth of one foot*) OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER (*Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.*)	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III (*shown in line numbers X-1 and X-2 below*): A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | T/A | C 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 2	309,700	G		7				
	0 4	50,000	U		8				
3	S 0 1	16,500	G		9				
4					10				

continued from the front

III. PROCESSES (continued)

C. SPACE FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES (code "T04"). FOR EACH PROCESS ENTERED HERE INCLUDE DESIGN CAPACITY.

T04 REPRESENTS TOTAL SOLVENT & FUEL RECYCLING CAPACITY

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER – Enter the four-digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If you handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four–digit number*(s)* from 40 CFR, Subpart C that describes the characteristics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY – For each listed waste entered in column A estimate the quantity of that waste that will be handled on an annual basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non–listed waste*(s)* that will be handled which possess that characteristic or contaminant.

C. UNIT OF MEASURE – For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropriate codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking into account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:
   For listed hazardous waste: For each listed hazardous waste entered in column A select the code*(s)* from the list of process codes contained in Item III to indicate how the waste will be stored, treated, and/or disposed of at the facility.
   For non–listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code*(s)* from the list of process codes contained in Item III to indicate *all* the processes that will be used to store, treat, and/or dispose of all the non–listed hazardous wastes that possess that characteristic or toxic contaminant.
   Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in the extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code*(s)*.
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER – Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total annual quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line enter "included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV *(shown in line numbers X-1, X-2, X-3, and X-4 below)* – A facility will treat and dispose of an estimated 900 pounds per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non–listed wastes. Two wastes are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estimated 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K 0 5 4	900	P	T 0 3	D 8 0			
	D 0 0 2	400	P	T 0 3	D 8 0			
X-3	D 0 0 1	100	P	T 0 3	D 8 0			
X-4	D 0 0 2							included with above

Continued from page 2.
NOTE: Photocopy this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

EPA I.D. NUMBER (enter from page 1)	T/A	C	FOR OFFICIAL USE ONLY	T/A	C	
W I N D 0 1 6 3 6 0 2 6 5		1	W DUP		2	DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO. (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F 0 0 1	350	T	S 0 1	S 0 2	T 0 4		
2	F 0 0 2	350	T	S 0 1	S 0 2	T 0 4		
3	F 0 0 3	1000	T	S 0 1	S 0 2	T 0 4		
4	F 0 0 5	1000	T	S 0 1	S 0 2	T 0 4		
5	D 0 0 1	20,000	T	S 0 1	S 0 2	T 0 4		
6								
7								
8								
9								
10								
11								
13								
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16								
17								
18								
19								
20								
21								
22								
23								
25								
26								

EPA Form 3510-3 (6-80)

CONTINUE ON RE

(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

Continued from the front.

IV. DESCRIPTION OF HAZARDOUS WASTES *(continued)*

E. USE THIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

T04 REPRESENTS SOLVENT & FUEL RECYCLING

EPA I.D. NO. *(enter from page 1)*

F | I N D 0 1 6 3 6 0 2 6 5 | T/A | C 6

V. FACILITY DRAWING

All existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

VI. PHOTOGRAPHS

All existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, treatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

VII. FACILITY GEOGRAPHIC LOCATION

LATITUDE *(degrees, minutes, & seconds)*	LONGITUDE *(degrees, minutes, & seconds)*
41 31 2	37 24 58

VIII. FACILITY OWNER

[X] A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. *(area code & no.)*
E	

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
F	G		

IX. OWNER CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED
James Tarpo	James Tarpo	6-2-86

X. OPERATOR CERTIFICATION

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME *(print or type)*	B. SIGNATURE	C. DATE SIGNED

CONTINUE ON PAGE

United States Environmental Protection Agency
Washington, DC 20460

EPA Notification of Hazardous Waste Activity

Please refer to the Instructions for Filing Notification before completing this form. The information requested here is required by law (Section 3010 of the Resource Conservation and Recovery Act).

For Official Use Only

Comments

Installation's EPA ID Number	Approved	Date Received (yr. mo. day)
C F I N D 0 1 6 3 6 0 2 6 5 T/A C 1		

I. Name of Installation

AMERICAN CHEMICAL SERVICE INC

II. Installation Mailing Address

Street or P.O. Box		
C 3 P O BOX 190		
City or Town	**State**	**ZIP Code**
C 4 GRIFFITH	IN	46319

III. Location of Installation

Street or Route Number		
C 5 420 S O COLFAX AVE		
City or Town	**State**	**ZIP Code**
C 6 GRIFFITH	IN	46319

IV. Installation Contact

Name and Title (last, first, and job title)	Phone Number (area code and number)
2 TARPO JAMES PRES	2199244370

V. Ownership

A. Name of Installation's Legal Owner	B. Type of Ownership (enter code)
C 8 AMERICAN CHEMICAL SER	P

VI. Type of Regulated Waste Activity (Mark 'X' in the appropriate boxes. Refer to instructions.)

A. Hazardous Waste Activity

- [X] 1a. Generator
- [ ] 1b. Less than 1,000 kg/mo.
- [ ] 2. Transporter
- [X] 3. Treater/Storer/Disposer
- [ ] 4. Underground Injection
- [X] 5. Market or Burn Hazardous Waste Fuel (enter 'X' and mark appropriate boxes below)
  - [X] a. Generator Marketing to Burner
  - [X] b. Other Marketer
  - [X] c. Burner

B. Used Oil Fuel Activities

- [ ] 6. Off-Specification Used Oil Fuel (enter 'X' and mark appropriate boxes below)
  - [ ] a. Generator Marketing to Burner
  - [ ] b. Other Marketer
  - [ ] c. Burner
- [ ] 7. Specification Used Oil Fuel Marketer (or On site Burner) Who First Claims the Oil Meets the Specification

VII. Waste Fuel Burning: Type of Combustion Device

(enter 'X' in all appropriate boxes to indicate type of combustion device(s) in which hazardous waste fuel or off-specification used oil fuel is burned. See instructions for definitions of combustion devices.)

- [ ] A. Utility Boiler
- [X] B. Industrial Boiler
- [X] C. Industrial Furnace

VIII. Mode of Transportation (transporters only — enter 'X' in the appropriate box(es)

- [ ] A. Air
- [ ] B. Rail
- [ ] C. Highway
- [ ] D. Water
- [ ] E. Other (specify)

IX. First or Subsequent Notification

Mark 'X' in the appropriate box to indicate whether this is your installation's first notification of hazardous waste activity or a subsequent notification. If this is not your first notification, enter your Installation's EPA ID Number in the space provided below.

- [ ] A. First Notification
- [X] B. Subsequent Notification (complete item C)

C. Installation's EPA ID Number: I N D 0 1 6 3 6 0 2 6 5

EPA Form 8700-12 (Rev. 11-85) Previous edition is obsolete.

Continue on reverse

ID — For Official Use Only														
C													T/A	C
W														1

Description of Hazardous Wastes *(continued from front)*

Hazardous Wastes from Nonspecific Sources. Enter the four-digit number from 40 *CFR* Part 261.31 for each listed hazardous waste [illegible] nonspecific sources your installation handles. Use additional sheets if necessary.

1	2	3	4	5	6
F 0 0 1	F 0 0 2	F 0 0 3	F 0 0 5		
7	**8**	**9**	**10**	**11**	**12**

B. Hazardous Wastes from Specific Sources. Enter the four-digit number from 40 *CFR* Part 261.32 for each listed hazardous waste from specific sources your installation handles. Use additional sheets if necessary.

13	14	15	16	17	18
19	**20**	**21**	**22**	**23**	**24**
25	**26**	**27**	**28**	**29**	**30**

C. Commercial Chemical Product Hazardous Wastes. Enter the four-digit number from 40 *CFR* Part 261.33 for each chemical substance your installation handles which may be a hazardous waste. Use additional sheets if necessary.

31	32	33	34	35	36
37	**38**	**39**	**40**	**41**	**42**
43	**44**	**45**	**46**	**47**	**48**

D. Listed Infectious Wastes. Enter the four-digit number from 40 *CFR* Part 261.34 for each hazardous waste from hospitals, veterinary hospitals, or medical and research laboratories your installation handles. Use additional sheets if necessary.

49	50	51	52	53	54

E. Characteristics of Nonlisted Hazardous Wastes. Mark 'X' in the boxes corresponding to the characteristics of nonlisted hazardous wastes your installation handles. *(See 40 CFR Parts 261.21 — 261.24)*

☒ 1. Ignitable *(D001)* ☐ 2. Corrosive *(D002)* ☐ 3. Reactive *(D003)* ☒ 4. Toxic *(D000)*

XI. Certification

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached documents, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

Signature	Name and Official Title *(type or print)*	Date Signed
James Tarpo	JAMES TARPO, PRESIDENT	1-22-86

3.

INDIANA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
NANCY A. MALOLEY, Commissioner

105 South Meridian Street
P.O. Box 6015
Indianapolis 46206-6015
Telephone 317-232-8603

December 10, 1987

Mr. John J. Murphy
Vice President
American Chemical Service, Inc.
P.O. Box 190
Griffith, IN 46319

Re: Part A Change
American Chemical Service, Inc.
IND 016360265

Dear Mr. Murphy:

We have reviewed your letter of July 10, 1987, where you forwarded a Part A change request. The addition of Tank No. 1002 to your Part A permit and therefore the increase in the tank storage (S02) design capacity from 315,000 gallons to 320,700 gallons is approved. This approved Part A application is dated January 22, 1986.

This tank has previously been in use at American Chemical Service Inc., for storage of distilled solvents which was sold as boiler fuel. The burning of these distilled solvents as hazardous waste derived fuel has now come under regulation. This process had not been previously regulated so it was not included in previous Part A or in your Part B Permit Application. We are also in receipt of your September 2, 1987, letter which amended your Part B Application to include Tank No. 1002.

If you have any questions, please call Mr. Bob Cappiello of my staff at AC 317/232-3221.

Sincerely,

Jane Magee

Jane Magee
Assistant Commissioner for
Solid and Hazardous Waste Management

RJC/ram

cc: Mr. Hak Cho, U.S. EPA, Region V
Mr. Bernie Orenstein, U.S. EPA, Region V
RCRA File 1C1d
Mr. Terry Gray
Mr. Jim Hunt

U.S. ENVIRONMENTAL PROTECTION AGENCY

HAZARDOUS WASTE PERMIT APPLICATION

Consolidated Permits Program

(This information is required under Section 3005 of RCRA.)

EPA

I. EPA I.D. NUMBER

F | I | N D 0 1 6 3 6 0 2 6 5

OFFICIAL USE ONLY

APPLICATION APPROVED	DATE RECEIVED (yr., mo., & day)	COMMENTS

II. FIRST OR REVISED APPLICATION

Place an "X" in the appropriate box in A or B below *(mark one box only)* to indicate whether this is the first application you are submitting for your facility or revised application. If this is your first application and you already know your facility's EPA I.D. Number, or if this is a revised application, enter your facility's EPA I.D. Number in Item I above.

A. FIRST APPLICATION *(place an "X" below and provide the appropriate date)*

☐ 1. EXISTING FACILITY *(See instructions for definition of "existing" facility. Complete item below.)*

☐ 2. NEW FACILITY *(Complete item below.)*

8 | YR. | MO. | DAY | FOR EXISTING FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR THE DATE CONSTRUCTION COMMENCED *(use the boxes to the left)*

YR. | MO. | DAY | FOR NEW FACILITIES, PROVIDE THE DATE *(yr., mo., & day)* OPERATION BEGAN OR IS EXPECTED TO BEGIN

B. REVISED APPLICATION *(place an "X" below and complete Item I above)*

☒ 1. FACILITY HAS INTERIM STATUS

☐ 2. FACILITY HAS A RCRA PERMIT

III. PROCESSES – CODES AND DESIGN CAPACITIES

A. PROCESS CODE — Enter the code from the list of process codes below that best describes each process to be used at the facility. Ten lines are provided for entering codes. If more lines are needed, enter the code(s) in the space provided. If a process will be used that is not included in the list of codes below, then describe the process *(including its design capacity)* in the space provided on the form *(Item III-C)*.

B. PROCESS DESIGN CAPACITY — For each code entered in column A enter the capacity of the process.
1. AMOUNT — Enter the amount.
2. UNIT OF MEASURE — For each amount entered in column B(1), enter the code from the list of unit measure codes below that describes the unit of measure used. Only the units of measure that are listed below should be used.

PROCESS	PROCESS CODE	APPROPRIATE UNITS OF MEASURE FOR PROCESS DESIGN CAPACITY
Storage:		
CONTAINER *(barrel, drum, etc.)*	S01	GALLONS OR LITERS
TANK	S02	GALLONS OR LITERS
WASTE PILE	S03	CUBIC YARDS OR CUBIC METERS
SURFACE IMPOUNDMENT	S04	GALLONS OR LITERS
Disposal:		
INJECTION WELL	D79	GALLONS OR LITERS
LANDFILL	D80	ACRE-FEET *(the volume that would cover one acre to a depth of one foot)* OR HECTARE-METER
LAND APPLICATION	D81	ACRES OR HECTARES
OCEAN DISPOSAL	D82	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	D83	GALLONS OR LITERS
Treatment:		
TANK	T01	GALLONS PER DAY OR LITERS PER DAY
SURFACE IMPOUNDMENT	T02	GALLONS PER DAY OR LITERS PER DAY
INCINERATOR	T03	TONS PER HOUR OR METRIC TONS PER HOUR; GALLONS PER HOUR OR LITERS PER HOUR
OTHER *(Use for physical, chemical, thermal or biological treatment processes not occurring in tanks, surface impoundments or incinerators. Describe the processes in the space provided; Item III-C.)*	T04	GALLONS PER DAY OR LITERS PER DAY

UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE	UNIT OF MEASURE	UNIT OF MEASURE CODE
GALLONS	G	LITERS PER DAY	V	ACRE-FEET	A
LITERS	L	TONS PER HOUR	D	HECTARE-METER	F
CUBIC YARDS	Y	METRIC TONS PER HOUR	W	ACRES	B
CUBIC METERS	C	GALLONS PER HOUR	E	HECTARES	Q
GALLONS PER DAY	U	LITERS PER HOUR	H		

EXAMPLE FOR COMPLETING ITEM III *(shown in line numbers X-1 and X-2 below)*: A facility has two storage tanks, one tank can hold 200 gallons and the other can hold 400 gallons. The facility also has an incinerator that can burn up to 20 gallons per hour.

C | DUP | T/A C | 1

LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT (specify)	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY	LINE NUMBER	A. PROCESS CODE (from list above)	B. PROCESS DESIGN CAPACITY 1. AMOUNT	2. UNIT OF MEASURE (enter code)	FOR OFFICIAL USE ONLY
X-1	S 0 2	600	G		5				
X-2	T 0 3	20	E		6				
1	S 0 2	320,700			7				
2	4	50,000			8				
3	S 0 1	16,500			9				
4					10				

...y this page before completing if you have more than 26 wastes to list.

Form Approved OMB No. 158-S80004

I.D. NUMBER (enter from page 1): W D 0 1 6 3 6 0 2 6 5 | T/A C: 1

FOR OFFICIAL USE ONLY: W DUP | T/A C: 2 | DUP

IV. DESCRIPTION OF HAZARDOUS WASTES (continued)

LINE NO.	A. EPA HAZARD. WASTE NO (enter code)	B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
1	F 0 0 1	350	T	S 0 1	S 0 2	T 0 4		
2	F 0 0 2	350	T	S 0 1	S 0 2	T 0 4		
3	F 0 0 3	6000	T	S 0 1	S 0 2	T 0 4		
4	F 0 0 5	6000	T	S 0 1	S 0 2	T 0 4		
5	D 0 0 1	5000	T	S 0 1	S 0 2	T 0 4		
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
25								
26								

EPA Form 3510-3 (6-80)

CONTINUE ON REVERSE

(enter "A", "B", "C", etc. behind the "3" to identify photocopied pages)

.ne front.

.PTION OF HAZARDOUS WASTES (continued)

.HIS SPACE TO LIST ADDITIONAL PROCESS CODES FROM ITEM D(1) ON PAGE 3.

T04 REPRESENTS SOLVENT & FUEL RECYCLING

EPA I.D. NO. (enter from page 1)

												T/A	C
I	N	D	0	1	6	3	6	0	2	6	5		6

. FACILITY DRAWING

.ll existing facilities must include in the space provided on page 5 a scale drawing of the facility *(see instructions for more detail).*

:. PHOTOGRAPHS

.ll existing facilities must include photographs *(aerial or ground—level)* that clearly delineate all existing structures; existing storage, .eatment and disposal areas; and sites of future storage, treatment or disposal areas *(see instructions for more detail).*

I. LITY GEOGRAPHIC LOCATION

LATITUDE (degrees, minutes, & seconds)	LONGITUDE (degrees, minutes, & seconds)
41 31 2	37 24 58

II. FACILITY OWNER

☒ A. If the facility owner is also the facility operator as listed in Section VIII on Form 1, "General Information", place an "X" in the box to the left and skip to Section IX below.

B. If the facility owner is not the facility operator as listed in Section VIII on Form 1, complete the following items:

1. NAME OF FACILITY'S LEGAL OWNER	2. PHONE NO. (area code & no.)

3. STREET OR P.O. BOX	4. CITY OR TOWN	5. ST.	6. ZIP CODE
	G		

. OWNER CERTIFICATION

.ertify under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached .cuments, and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the .bmitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, .cluding the possibility of fine and imprisonment.

NAME (print or type)	B. SIGNATURE	C. DATE SIGNED
James Tarpo		10 July 87

OPERATOR CERTIFICATION

.ertif.. under penalty of law that I have personally examined and am familiar with the information submitted in this and all attached .cu. , and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the .m information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, .luding the possibility of fine and imprisonment.

NAME (print or type)	B. SIGNATURE	C. DATE SIGNED

...n the front.

...SSES (continued)

...FOR ADDITIONAL PROCESS CODES OR FOR DESCRIBING OTHER PROCESSES (code "T04"). FOR EACH PROCESS ENTERED HERE ...UDE DESIGN CAPACITY.

T04 REPRESENTS TOTAL SOLVENT & FUEL RECYCLING CAPACITY

IV. DESCRIPTION OF HAZARDOUS WASTES

A. EPA HAZARDOUS WASTE NUMBER — Enter the four-digit number from 40 CFR, Subpart D for each listed hazardous waste you will handle. If y... handle hazardous wastes which are not listed in 40 CFR, Subpart D, enter the four-digit number(s) from 40 CFR, Subpart C that describes the characte...tics and/or the toxic contaminants of those hazardous wastes.

B. ESTIMATED ANNUAL QUANTITY — For each listed waste entered in column A estimate the quantity of that waste that will be handled on an ann... basis. For each characteristic or toxic contaminant entered in column A estimate the total annual quantity of all the non-listed waste(s) that will be handl... which possess that characteristic or contaminant.

C. UNIT OF MEASURE — For each quantity entered in column B enter the unit of measure code. Units of measure which must be used and the appropr... codes are:

ENGLISH UNIT OF MEASURE	CODE	METRIC UNIT OF MEASURE	CODE
POUNDS	P	KILOGRAMS	K
TONS	T	METRIC TONS	M

If facility records use any other unit of measure for quantity, the units of measure must be converted into one of the required units of measure taking ir... account the appropriate density or specific gravity of the waste.

D. PROCESSES

1. PROCESS CODES:

For listed hazardous waste: For each listed hazardous waste entered in column A select the code(s) from the list of process codes contained in Item ... to indicate how the waste will be stored, treated, and/or disposed of at the facility.

For non-listed hazardous wastes: For each characteristic or toxic contaminant entered in column A, select the code(s) from the list of process c... contained in Item III to indicate all the processes that will be used to store, treat, and/or dispose of all the non-listed hazardous wastes that po... that characteristic or toxic contaminant.

Note: Four spaces are provided for entering process codes. If more are needed: (1) Enter the first three as described above; (2) Enter "000" in ... extreme right box of Item IV-D(1); and (3) Enter in the space provided on page 4, the line number and the additional code(s).

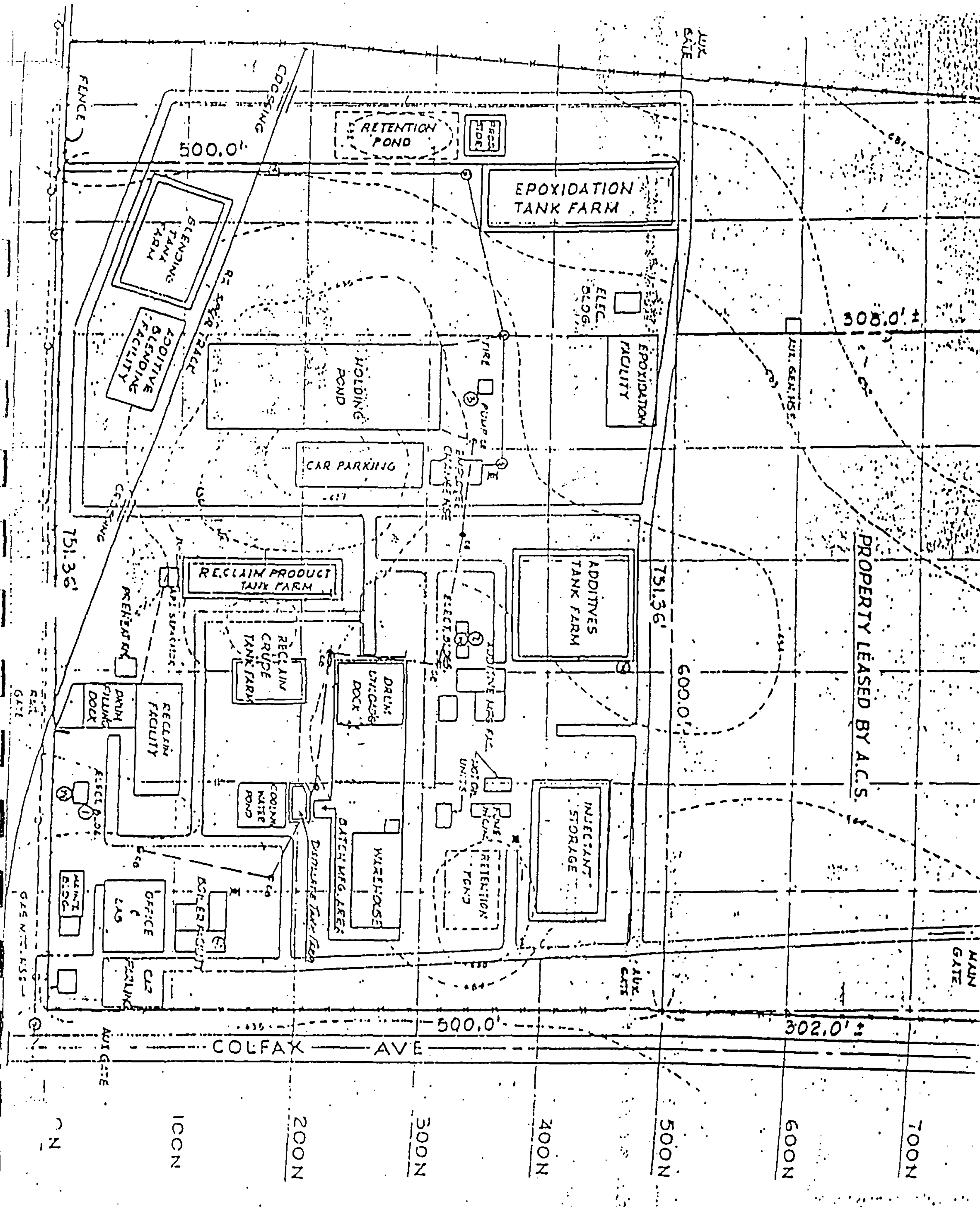
2. PROCESS DESCRIPTION: If a code is not listed for a process that will be used, describe the process in the space provided on the form.

NOTE: HAZARDOUS WASTES DESCRIBED BY MORE THAN ONE EPA HAZARDOUS WASTE NUMBER — Hazardous wastes that can be described by more than one EPA Hazardous Waste Number shall be described on the form as follows:

1. Select one of the EPA Hazardous Waste Numbers and enter it in column A. On the same line complete columns B,C, and D by estimating the total a... quantity of the waste and describing all the processes to be used to treat, store, and/or dispose of the waste.
2. In column A of the next line enter the other EPA Hazardous Waste Number that can be used to describe the waste. In column D(2) on that line ... "Included with above" and make no other entries on that line.
3. Repeat step 2 for each other EPA Hazardous Waste Number that can be used to describe the hazardous waste.

EXAMPLE FOR COMPLETING ITEM IV (shown in line numbers X-1, X-2, X-3, and X-4 below) — A facility will treat and dispose of an estimated 900 po... per year of chrome shavings from leather tanning and finishing operation. In addition, the facility will treat and dispose of three non-listed wastes. Two w... are corrosive only and there will be an estimated 200 pounds per year of each waste. The other waste is corrosive and ignitable and there will be an estim... 100 pounds per year of that waste. Treatment will be in an incinerator and disposal will be in a landfill.

LINE NO.	A. EPA HAZARD. WASTE NO (enter code)				B. ESTIMATED ANNUAL QUANTITY OF WASTE	C. UNIT OF MEASURE (enter code)	D. PROCESSES 1. PROCESS CODES (enter)				D. PROCESSES 2. PROCESS DESCRIPTION (if a code is not entered in D(1))
X-1	K	0	5	4	900	P	T 0 3	D 8 0			
[illegible]	[illegible]	0	0	2	400	P	T 0 3	D 8 0			
X-3	D	0	0	1	100	P	T 0 3	D 8 0			
X-4	D	0	0	2							Included with above


RETENTION POND
500.0'
EPOXIDATION TANK FARM
FENCE
CROSSING
BLENDING TANK FARM
ADDITIVE BLENDING FACILITY
RR SPUR TRACK
ELEC. BLDG.
300.0' ±
EPOXIDATION FACILITY
HOLDING POND
CAR PARKING
FIRE PUMPS
751.36'
RECLAIM PRODUCT TANK FARM
ADDITIVES TANK FARM
PROPERTY LEASED BY A.C.S.
RECLAIM CRUDE TANK FARM
DRUM UNLOAD DOCK
DRUM FILLING DOCK
RECLAIM FACILITY
600.0'
COOLING WATER POND
INSECTANT STORAGE
RETENTION POND
WAREHOUSE
BATCH MFG. FAC.
OFFICE & LAB
MAINT. BLDG.
BOILER FACILITY
AUX. GATE
MAIN GATE
500.0'
302.0' ±
COLFAX AVE
0 N
100 N
200 N
300 N
400 N
500 N
600 N
700 N

APPENDIX B

STORAGE TANK ASSESSMENT AND CERTIFICATION
RCRA TANK FARMS #1 AND #2

ATEC Associates, Inc.

☐ 1501 East Main Street • Griffith, Indiana 46319 (219) 924-6690/(312) 375-9092
☐ 130 Eisenhower Lane South • Lombard, Illinois 60148 (312) 932-0070

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Offices:
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Baltimore, MD
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Chicago, IL
Cincinnati, OH
Dallas, TX
Dayton, OH
Denver, CO
Freeport, TX
Gary, IN
Houston, TX
Huntsville, AL
Lexington, KY
Louisville, KY
Newport, NC
Raleigh, NC
Salisbury, MD
Savannah, GA
Washington, DC
York, PA
Affiliates:
Alexandria, VA
Norfolk, VA

January 11, 1988
File 7-3227

American Chemical Services, Inc.
ATTN: Mr. John J. Murphy, Vice President
420 S. Colfax Avenue
P.O. Box 190
Griffith, IN 46319

REPORT
Storage Tank Assessment and Certification
American Chemical Service, Inc.
RCRA Tank Farms #1 and #2
Griffith, Indiana

Dear Mr. Murphy:

We have completed our assessment and certification of twenty one (21) above-ground RCRA waste storage vessels. This work was completed in general accordance with our proposal dated April 30, 1987.

A narrative summary of our evaluation of these vessels is presented in the body of this report. Based on our evaluation, we certify that in our opinion, these tank systems are adequately designed, currently have sufficient structural strength, and are acceptable for storing the specified materials.

We trust this information is sufficient for your needs.

Very truly yours,
Atec Associates, Inc.

Steven Stanford
Geologist

John W Weaver II

John W. Weaver II, P.E.
Vice President

TABLE OF CONTENTS

ATEC

Storage Tank Assessment and Certification
American Chemical Services
RCRA Tank Farms #1 and #2
Griffith, Indiana

1.0 INTRODUCTION

1.1 General

ATEC Associates, Inc. (ATEC) was contracted by American Chemical Services (ACS) to prepare this written assessment of existing RCRA Storage tank facilities currently in use at ACS in Griffith, Indiana. This assessment is based upon a review of design standards, ACS vessel inspection records and reports, plumbing and piping pressure test results, hydrostatic test results, and an on-site visual inspection of each tank system. We did not perform testing of welds of perform independent design calculations.

This assessment report was prepared in accordance with the requirements outlined in 40 CFR 264.191 and presented in detail in interpretation of the regulations, we reviewed and addressed more detailed requirements set forth in the "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems", U.S. EPA Office of Solid Waste, December, 1986.

1.2 Organization

The results of our assessment and findings are presented in the body of this report. Pertinent data, including tank I.D. numbers, installation dates, capacities, and tank contents are summarized in the "Tables" Section. Results of leak tests and our visual inspections for each vessel are presented in Appendix A. General tank information, including company inspection reports and a written assessment of tank shell thicknesses are presented in Appendix B.

1.3 Subject of Assessment and Certification

In summary, twenty one (21) RCRA waste storage tanks are addressed by this assessment report. A list of tanks and their I.D. numbers is presented in Table 1. The RCRA storage tank locations are shown in Figure 1.

1.4 Design Standard Assessment

Based on our visual observations and conversations with Mr. John J. Murphy of ACS, all tanks were designed in accordance with the document API Standard 650, "Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks."

1.4.1 Shell Thickness Testing

All tank shells were testing for thickness of the tank walls, and roof, by ACS personnel during the summer of 1987. Thicknesses were measured using a Parametrics Ultrasonic Thickness Gauge, Model 5226. Each tank was measured by first scraping the painted surface to the bare metal. A thin film of conductivity grease was applied to the area and the measurement was taken. The equipment was recalibrated for each tank from a standard block. The number of points measured for each tank was based on the variation of the readings.

For dish bottom tanks, a minimum of three readings were taken on the bottom dish, one about 12" from the bottom nozzle, one halfway to the sidewall, and one 12" from the sidewall. Further, readings were obtained 6 inches up the sidewall, one on either side of the first seam and one on either side of the second seam. If discrepancies developed, more readings were taken. The flat bottom tanks were measured at the following locations: Two 6" up the sidewall (one adjacent to the transfer nozzle), one one either side of the first seam, one on either side of the second seam and one on the either side of the third seam. Again, if discrepancies developed more readings were taken. The recorded metal thicknesses were based on the minimum readings.

Tank thickness test results indicate that tank wall thinning has been consistently small. Two verification measurements per tank were taken by ACS personnel and observed and recorded by ATEC on December 9, 1987. These verification measurements deviated a maximum of 8.5 percent from earlier measurements, with a absolute mean variation of approximately 2 percent.

1.5 Hazardous Characteristics

According to U.S. EPA Guidance, an assessment of hazardous characteristics for handled wastes should address the compatibility of handled wastes with tank and or liner materials. Our compatibility assessment was prepared by evaluating loss of tank thickness as documented by ACS personnel in the attachment reproduced in Appendix B.

The tanks subject to this assessment are constructed of A 283C carbon steel. With the exception of tanks #1A, #1B, #116, #120, #121, #203, #206, #212, average yearly shell thickness loss rates are less than the "conservative" limit of 0.002 inches per year prescribed in the U.S. EPA guidance document.[1] We therefore believe that these tanks are sufficiently compatible for continued similar use.

The following tanks lost more than 0.002 inches per year of shell thickness:

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Tank I.D.	Average Thickness Lost Per Year
#1A	0.004 inches
#1B	0.0039
#116	0.005
#120	0.0023
#121	0.004
#203	0.0021
#206	0.0022
#212	0.0074

To evaluate these tanks, ACS has calculated minimum allowable shell thicknesses using the method outlined in API 650 A 4.1. Using this method, ACS has determined that current (1987) shell thicknesses for these tanks still exceed the minimum API thickness requirements (including a corrosion allowance) by factors of 1.3 to 14. Based on the greatest calculated shell thickness loss rate of 0.0074 inches per year, Tank #212 should maintain a sufficient shell thickness for approximately five (5) years. Thus, with annual shell thickness monitoring, we believe that these tanks also exhibit sufficient compatibility for continued similar use.

1.6 Leak Test Results

Vessels #202, #203, #204, #205, #206, #210, #211, and #212, located in tank farm #1, were each hydrostatically tested by transferring product such that each tank was observed at full working capacity. No visible signs of leakage were observed for these tanks. Further, this hydrostatic test served to demonstrate that these tank posses sufficient strength to contain their full hydrostatic loads.

Due to their unique contents, the stored wastes contained in tanks #A1, #B1, #116, #117, #118, #119, #120, #121, #122, #123, #124, #125, and #126, product could not be transferred to fill

ATEC

each tank to working capacity. Therefore, these tanks were subject to a exterior visual inspection described below.

Ancillary equipment for the twenty one (21) tanks subject to this assessment was pressure tested for tightness using a method developed specifically for the system. The ancillary equipment is defined as all piping, valves, joints, gaskets, and pumps associated with each tank farm, within the boundaries shown in Figure 1. Nitrogen was applied to each of the lines at a minimum of 25 pounds per square inch.

A soap water mixture was applied to the pumps, joints, welds, and valves of the entire system to facilitate detection of nitrogen leaks. Points in the system that failed to be pressure tight was immediately repaired and retested to assure tightness. At completion of pressure testing, all ancillary equipment within each tank farm passed this leak test.

1.7 Visual Inspection Results

The twenty one (21) tank systems subject to this assessment were physically inspected on December 9, 1987 by ATEC. The check list used for the inspection was based on the publication "Guide for Inspection of Refinery Equipment, Chapter VIII - "Atmosheric and Low-Pressure Storage Tanks" published by the American Petroleum Institute. Listed below are the items physically inspected at each system.

Anchor bolts - where possible
Welds
Pipe supports
Nozzle connections
Tank walls
Roof foundations
Vents and controls on tank roof
Gauges in operation

Protective coating
Indication of any leaks
Name plates
General Housekeeping

All 21 tank systems appeared to be in a good state of repair. We observed no deficiencies that appeared to affect the structural integrity of the tank system. The check list from the inspection of each tank is included in Appendix A.

1.8 Qualifications

At the time of this assessment, vessels and ancillary equipment subject to this certification were assessed to be free of leaks, structurally sound, and in a good state of general repair. In my opinion, the extent and scope of this study is in general accordance with the EPA guidance as expressed in the U.S. EPA "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems," December, 1986.

However, with the passage of time, site conditions or equipment usage conditions can be subject to change. Therefore, periodic reviews of system conditions should be completed. These reviews should include continuation of routine and non-routine inspection and maintenance of all vessels (including annual shell thickness monitoring) and ancillary equipment used to store, treat, or handle hazardous materials. If the usage or application of the facilities described in this report are at any time changed materially from the conditions described in this assessment, or if during operation, routine maintenance, or inspections it is discovered that information presented in this assessment is incorrect, of if observed leakage does occur, we should be informed immediately since the validity of our findings may be affected.

1.9 Certification Statement for Existing Tank Systems

I, John W. Weaver II, P.E. Certify for ATEC Associates, Inc., the following. These findings were obtained in accordance with standard petroleum industry and standard engineering practices. No other warranties are expressed or implied:

1. I am a qualified registered professional engineer and am not an employee of American Chemical Services, Inc. or an American Chemical Services, Inc. subsidiary.

2. The term "Tank System" in this Assessment and Certification refers to the following tank systems subject to this assessment: #116, #117, #118, #119, #120, #121, #122, #123, #124, #125, #126, #A1, #B1, #202, #203, #204, #205, #206, #210, #211, and #212 as identified and located in this assessment report.

3. In my opinion, based on my review of, or the review of others under my direction, the Design Information for these Tank Systems indicates that the Tank Systems have sufficient structural integrity and are currently acceptable for storing the materials identified in this assessment report.

4. In my opinion, the tank systems are adequately designed and currently have sufficient structural strength and compatibility with stored materials to ensure that it will not collapse, rupture, or fail.

I certify under penalty of law that this document and all attachments were prepared by me of under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John W Weaver II

John W. Weaver II, P.E.

19478

Professional Engineer's Number

Vice President

Title

ATEC Associates, Inc.

Firm

List of References

1. United States Environmental Protection Agency, Office of Solid Waste, "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems", December 1986.

ATEC

TABLES

TABLE 1
Listing of Vessels Subject to Assessment

Tank	year installed	Capacity (Gal)	Contents *1	Design *2
116	1982	10,800	b	a
117	1982	10,800	b	a
118	1982	10,800	b	a
119	1982	10,800	b	a
120	1981	6,000	b	a
121	1981	10,500	b	a
122	1981	10,500	b	a
123	1978	19,500	b	b
124	1978	19,500	b	b
125	1978	19,500	b	b
126	1978	19,500	b	b
A1	1981	2,750	a	a
B1	1981	2,750	a	a
202	1977	18,000	c	c
203	1977	16,000	c	c
204	1977	17,000	c	c
205	1977	18,000	c	c
206	1977	17,000	c	c
210	1977	23,000	c	c
211	1977	23,000	c	c
212	1981	24,000	c	c
220	1981	1,000	c	a

*1) a- Methylene Chloride, 1,1,1 Trichlorethylene Trichlorethylene, Perchloroethylene.
b- Acetone, Methanol, Methyl Ethel Ketone, Isopropyl Alcohol, Toluene, Hexane, Methly Isobutyl Ketone, Butyl Acetate, Xylene Mineral Spirits, Butyl Cellosolve, Butanol, Ethyl Acetate.
c- All of the above, Chlorinated not over 20% of the total concentration.

*2) a- Vertical on legs on a concrete slab.
b- Vertical with a flat bottom on a concrete slab.
c- Vertical with a flat bottom on a slag foundation.

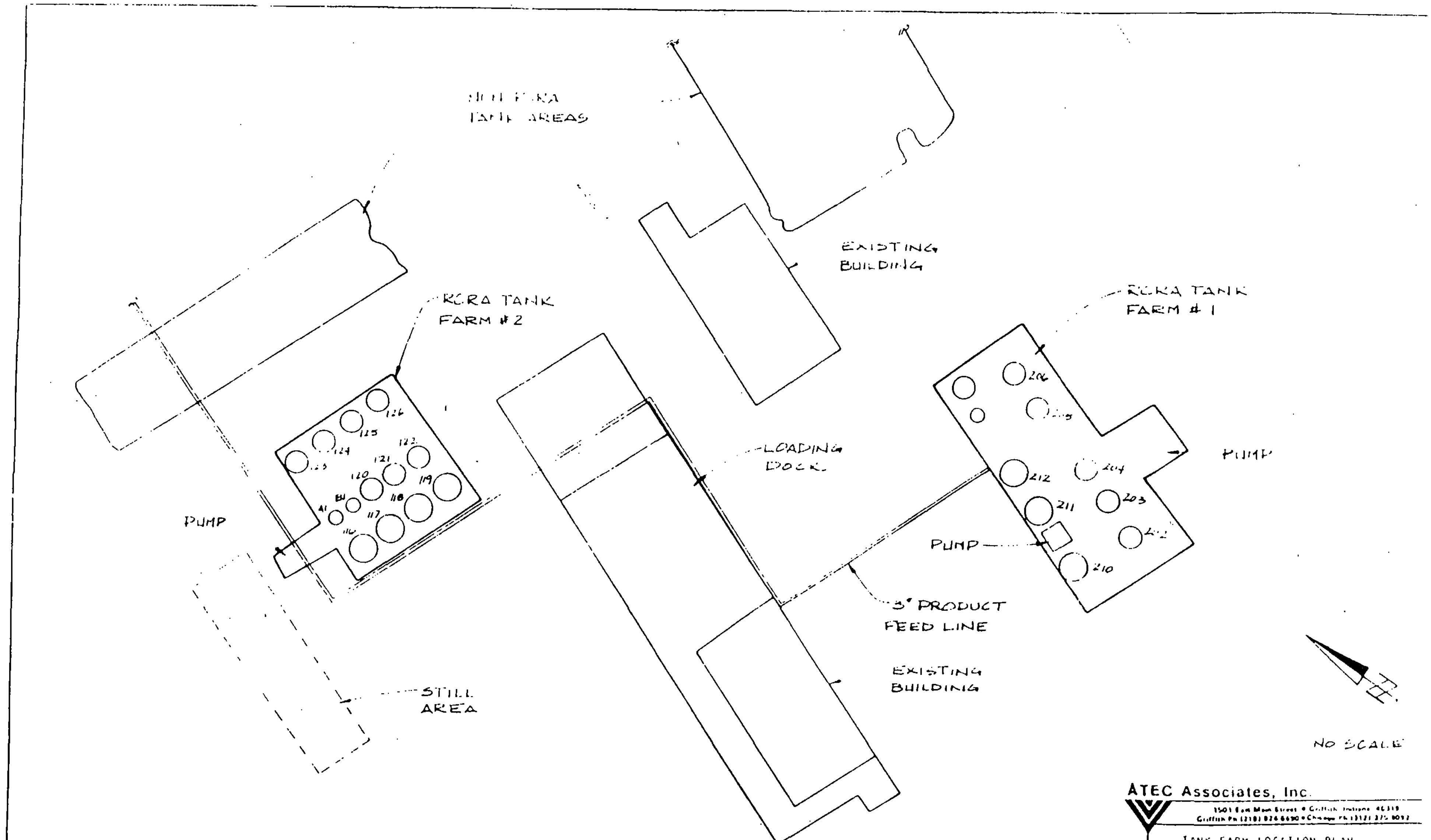
TABLE 2
Verification of Shell Thickness Testing

AMERICAN CHEMICAL SERVICES
TANK ASSESSMENT
TANK THICKNESS SUMMARY
FILE 7-3227

Tank Number	Measuring Point Elevation (ft)	Tank Side	Thickness (in) 5/87	Thickness (in) 12/9/87	Change Thickness (in)*1	Change Thickness %
116	10	S	0.235	0.236	0.001	0.4255
	10	N	0.238	0.240	0.002	0.8403
117	9	S	0.220	0.235	0.015	6.8182
	9	N	0.230	0.229	-0.001	-0.4348
118	9	S	0.226	0.231	0.005	2.2124
	9	N	0.230	0.232	0.002	0.8696
119	9	S	0.241	0.242	0.001	0.4149
	9	N	0.248	0.247	-0.001	-0.4032
120	5	E	0.242	0.254	0.012	4.9587
	5	W	0.246	0.254	0.008	3.2520
121	5	E	0.234	0.243	0.009	3.8462
	5	W	0.240	0.238	-0.002	-0.8333
122	5	E	0.249	0.249	0.000	0.0000
	5	W	0.249	0.248	-0.001	-0.4016
123	7	E	0.240	0.235	-0.005	-2.0833
	7	W	0.240	0.242	0.002	0.8333
124	7	E	0.236	0.239	0.003	1.2712
	7	W	0.244	0.240	-0.004	-1.6393
125	7	E	0.236	0.235	-0.001	-0.4237
	7	W	0.240	0.238	-0.002	-0.8333
126	7	E	0.234	0.233	-0.001	-0.4274
	7	W	0.237	0.231	-0.006	-2.5316
A1	5	E	0.446	0.452	0.006	1.3453
	5	W	0.439	0.450	0.011	2.5057
B1	5	E	0.420	0.430	0.010	2.3810
	5	W	0.432	0.432	0.000	0.0000
202	7	S	0.168	0.162	-0.006	-3.5714
	7	N	0.170	0.164	-0.006	-3.5294
203	6	S	0.144	0.145	0.001	0.6944
	6	N	0.148	0.144	-0.004	-2.7027
204	7	S	0.150	0.143	-0.007	-4.6667
	7	N	0.146	0.144	-0.002	-1.3699
205	7	S	0.187	0.171	-0.016	-8.5561
	7	N	0.177	0.171	-0.006	-3.3898
206	7	S	0.222	0.219	-0.003	-1.3514
	7	N	0.214	0.218	0.004	1.8692
210	7	S	0.162	0.162	0.000	0.0000
	7	N	0.155	0.158	0.003	1.9355
211	7	S	0.168	0.176	0.008	4.7619
	7	N	0.169	0.178	0.009	5.3254
212	7	S	0.162	0.153	-0.009	-5.5556
	7	N	0.167	0.158	-0.009	-5.3892
				MEAN:	0.0005	0.0021
				ABSOLUTE MEAN:	0.0049	2.1491

*1 - A positve thickness change indictes a increase in tank wall thickness. A negetive thickness change indicates a decrease in wall thickness.

FIGURES



ATEC Associates, Inc.

1501 East Main Street • Griffith, Indiana 46319
Griffith Ph (219) 924-6690 • Chicago Ph (312) 375-9012

TANK FARM LOCATION PLAN
AMERICAN CHEMICAL SERVICES
GRIFFITH, IN

FIGURE NO. 1

DRWN DC
CK
DATE [illegible] FILE [illegible]

APPENDIX A

1. ATEC Visual Inspection Reports

Pressure Testing

Plant Site: ACS - Griffith File No: 7-3227

Tank System #: J16 - 126 [illegible] piping

Date: 12-9-87

Inspected by: John M McBride

1) Testing method: Nitrogen was applied at 25 psi throughout the system. A soapy water was applied to all joints, welds, valves, and gasket packings to check for leaks

2) Leaks detected

a) 5 leaks at valve packs

3) Remedial action - results (if appropriate)

a) Leaks at 4 valve packs were repaired by tightening the valve

b) Release valve for Tank #123. This valve was repacked, retested, and passed

Pressure Testing

Plant Site: ACS - Griffith File No: 7-3227

Tank System #: 202-212 auxiliary piping

Date: 12-9-87

Inspected by: John M. McBride

1) Testing method: Nitrogen was applied at 25 psi throughout the system. A soapy water was applied to all joints, welds, valves, and gasket packings

2) Leaks detected

a) 4 leaks at valve packs

b) 1 leak at central suction pump gasket

3) Remedial action - results (if appropriate)

a) Valve packs all leaky valve packs were made pressure tight by tightening with a pipe wrench

b) Suction Gasket. The gasket was repacked, and then passed the test

Visual Inspection

Tank System # 16

Date: 12-4-87

Inspected by: JMM

Plant Site: ACS - Griffith

File No: 7-3227

Item

1) Weld breaks None apparent at tanks outer surface

2) Punctures No apparent evidence of puntures or leaks

3) Scrapes of protective coatings - none, tank is freshly painted.

4) Cracks none apparent at surface

5) Corrosion Slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks
No evidence of either

7) Others [illegible] concrete legs on concrete slab

8) General House Keeping [illegible]

Visual Inspection

Tank System # 117

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS Gr, Mich

File No: 7-3227

Item

1) Weld breaks None apparent on tank's outer surface

2) Punctures No apparent evidence of punctures or leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent at the surface

5) Corrosion Slight surface Corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of loose pipe connections or leaks

7) Others design of concrete legs on a concrete slab

8) General House keeping good

Visual Inspection

Tank System # 118

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS-Griffith

File No: 7-3227

Item

1) Weld breaks · None apparent at tank's outer surface.

2) Punctures No evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted.

4) Cracks none apparent at the surface

5) Corrosion slight surface corrosion, painted over.

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others designed [illegible] concrete legs on a concrete slab

8) General House keeping [illegible]

Visual Inspection

Tank System # 119

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS Griffith

File No: 7-3227

Item

1) Weld breaks None apparent at tank's outer surface

2) Punctures No apparent evidence of punctures or leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent on outer surface

5) Corrosion slight surface corrosion near top of tank, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others designed concrete legs on a concrete slab

8) General House keeping excellent

Visual Inspection

Tank System # 130

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS - Griffith

File No: 7-3227

Item

1) Weld breaks - None apparent at tanks outer surface

2) Punctures No evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent at outer surface

5) Corrosion none apparent on outer surface

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others Design 4 concrete legs on a concrete slab

8) General House keeping - [illegible]

Visual Inspection

Tank System # 121

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS - Gr, Mich

File No: 7-3227

Item

1) Weld breaks None apparent on tanks outer surface

2) Punctures - No apparent evidence of punctures or resulting leaks.

3) Scrapes of protective coatings None, tank is freshly painted.

4) Cracks None apparent on tanks outer surface.

5) Corrosion Slight surface corrosion, painted over.

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design - concrete legs on a concrete slab.

8) General House keeping good

Visual Inspection

Tank System # 122
Date: 12-9-87
Inspected by: JMM

Plant Site: ACS-Gr. Mich
File No: 7-3227

Item

1) Weld breaks - none apparent on tanks outer surface.

2) Punctures No apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted.

4) Cracks none apparent on outer surface

5) Corrosion none apparent on outer surface.

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others [illegible] concrete [illegible] concrete slab.

8) General House keeping [illegible]

Visual Inspection

Tank System # 123

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS-Griffith

File No: 7-3227

Item

1) Weld breaks - none apparent on tanks outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted.

4) Cracks none apparent on outer surface

5) Corrosion very slight surface corrosion, painted over.

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design - seated on a concrete pad

8) General House Keeping [illegible]

Visual Inspection

Tank System # 124
Date: 12-9-87
Inspected by: JMM

Plant Site: ACS-Griffith
File No: 7-3227

Item

1) Weld breaks none apparent on tank's outer surface.

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent on outer surface

5) Corrosion slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others [illegible] seated on a concrete pad

8) General House keeping [illegible]

Visual Inspection

Tank System # 125
Date: 12-9-87
Inspected by: JMB

Plant Site: ACS - Griffith
File No: 7-3227

Item

1) Weld breaks none apparent on tanks outer surface

2) Punctures no apparent evidence of punctures or leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent on outer surface

5) Corrosion very slight near base of tank, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design - seated on concrete pad

8) General House keeping excellent

Visual Inspection

Tank System # 126

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS Griffith

File No: 7-3227

Item

1) Weld breaks none apparent on tanks outer surface

2) Punctures no apparent evidence of punctures or resulting leaks.

3) Scrapes of protective coatings none, tank is freshly painted.

4) Cracks none apparent on outer surface

5) Corrosion possible slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others [illegible]

8) General House keeping excellent

Visual Inspection

Tank System # 91

Date: 12-9-87

Inspected by: JMM

Plant Site: [illegible]

File No: 7-3222

Item

1) Weld breaks none apparent at tanks outer surface

2) Punctures no evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent on outer surface

5) Corrosion slight corrosion on tank legs, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design of metal legs on concrete slab [illegible]

8) General House keeping [illegible]

Visual Inspection

Tank System # B-1
Date: 12-9-87
Inspected by: JMM

Plant Site: ACS Griffith
File No: 7-3227

Item

1) Weld breaks none apparent on tanks outer surface

2) Punctures No apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none, tank is freshly painted

4) Cracks none apparent on outer surface

5) Corrosion none apparent on outer surface

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design - [illegible] metal legs on concrete slab

8) General House keeping [illegible]

Visual Inspection

Tank System # 202
Date: 12-9-87
Inspected by: JMM

Plant Site: ACS-Griffith
File No: 7-3227

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings - Some scraps of paint near the top of the tank

4) Cracks none apparent on the tank's outer surface.

5) Corrosion slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of rats due to loose piping

7) Others - design - sealed on slag base

8) General House keeping good

Visual Inspection

Tank System # 303 Plant Site: ACS
Date: 12-9-77 File No: 7-3227
Inspected by: JMM

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no evidence of punctures or resulting leaks

3) Scrapes of protective coatings Any past scrapes have been repainted

4) Cracks none apparent on outer surface of tank

5) Corrosion slight on surface, a few spots have yet to be repainted.

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design seated on slag base
slight dent in tank wall at 15 feet

8) General House keeping good

Visual Inspection

Tank System # 2CU

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS

File No: 7-3227

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings None apparent

4) Cracks none apparent on outer surface of tank

5) Corrosion Some on outer surface of tank

6) Loose pipe connections - indications of leaks [illegible] of leaks due to loose piping

7) Others [illegible] settled on slag base

8) General House keeping [illegible]

Visual Inspection

Tank System # 205

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS-Griffith

File No: 7-3227

Item

1) Weld breaks none apparent on tanks outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none apparent

4) Cracks none apparent on outer surface

5) Corrosion very slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others [illegible] seal on [illegible] base [illegible] dent at top of tank

8) General House keeping [illegible]

Visual Inspection

Tank System # 206

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS Gr. Mill

File No: 7-3227

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings minimal, repainted.

4) Cracks none apparent on outer surface

5) Corrosion very slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others

8) General House keeping Good

Visual Inspection

Tank System # 210 | Plant Site: ACS
Date: 12-9-87 | File No: 7-3227
Inspected by: EMM

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no apparent evidence of punctures or resulting leaks.

3) Scrapes of protective coatings none apparent.

4) Cracks none apparent on outer surface

5) Corrosion slight on surface, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping

7) Others design - seated on slag base roof looks sound

8) General House keeping good

Visual Inspection

Tank System # 211

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS

File No: 7-3227

Item

1) Weld breaks none apparent on tanks outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none apparent

4) Cracks none apparent on outer surface of tank

5) Corrosion slight surface corrosion, painted over

6) Loose pipe connections - indications of leaks no evidence of leaks due to loose piping.

7) Others design - seated on slag base
a number of small leaks in tank

8) General House keeping Excellent

Visual Inspection

Tank System # 212

Date: 12-9-87

Inspected by: JMM

Plant Site: ACS

File No: 7-3227

Item

1) Weld breaks none apparent on tank's outer surface

2) Punctures no apparent evidence of punctures or resulting leaks

3) Scrapes of protective coatings none apparent.

4) Cracks none apparent on outer surface

5) Corrosion very slight surface corrosion, painted over.

6) Loose pipe connections - indications of leaks
Some signs of leakage at mixing pump
pump was repaired and leaks stopped (12/12/87)

7) Others design - seated on slag base

8) General House keeping - good

APPENDIX B

1. ACS Tank Inspection Reports

2. ACS Description of Tanks (Includes assessment of Tank Shell Thickness Data)

ATEC

TANK IDENT: 117

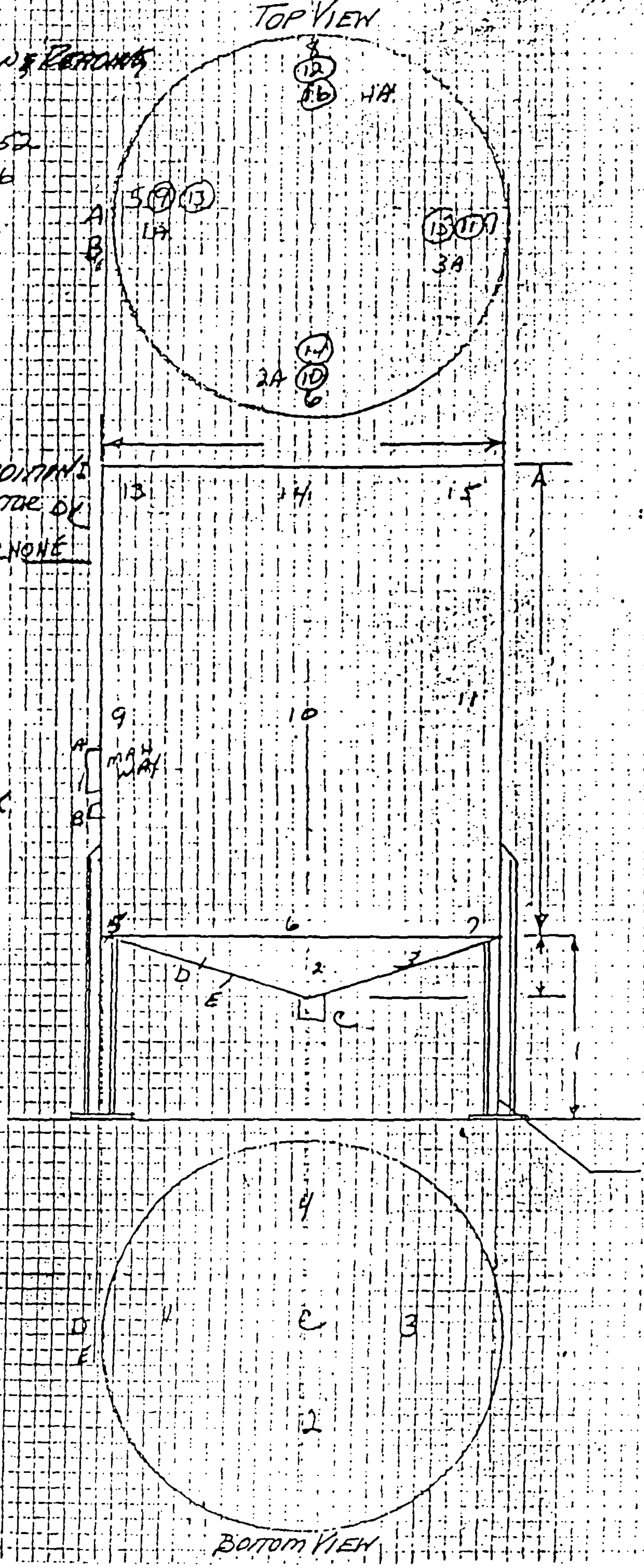
LOCATION: B

MAY 6, 198?

JUNE 10, 1986

NOZZLES AND CONDITION & REMARKS

1. MAN WAY O.K
2. 4" NIPPLE OK .152
3. 2" NIPPLE OK .146
4. 1½" NIPPLE OK
5. 1" COUPLING OK



CHECKED 8-12-87

SAFETY CONTROLS AND CONDITIONS

BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL NONE

LEVEL ALARM OK

DESIGN STANDARDS:

... EXTERIOR: OK

LEG DIAMETER:

NUMBER:

TANK: 1A

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL: STR SIDE .040

'NT	HEIGHT ABOVE STR. SIDE	READING
	BOTTOM CENTER OF CONE	.610
	"	.594
	"	.605
	"	.593
	BASE OF TANK	.446
	"	.448
	"	.439
	"	.444
	FIVE FEET ABOVE BASE	.449
	"	.451
	"	.447
	"	.469
	TOP SIDE OF TANK	.422
		.400
		.414
		.437
	TOP OF TANK	.533
		.546
		.542
		.558

ANK IDENT: 1A

XATION: RECLAIM CRUDE

JUNE 10, 1986

OZZLES AND CONDITION:

OK

OK

13? O.K

VISUAL OK

OK

AFETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR

OK OK

GAUGE AND LIQUID SEAL

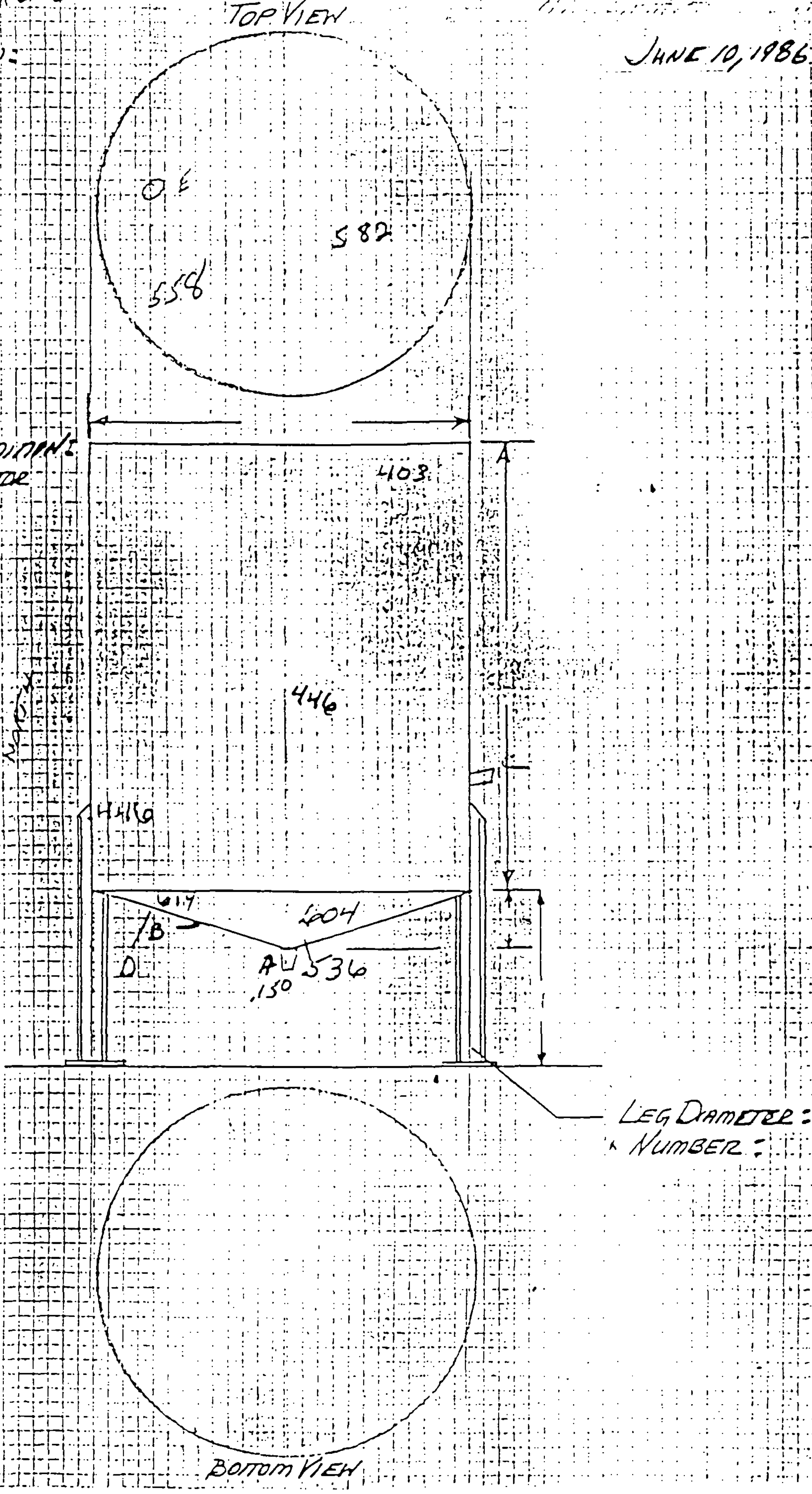
LEVEL ALARM OK

SIGN STANDARDS:

NK EXTERIOR:

O.K

IS NOT FIRE PROOF



TANK PROFILE

DATE: MAY 6, 198

TANK IDENT: 1B

LOCATION: B

JUNE 10, 1986

NOZZLES AND CONDITION & REMARKS

1.	4 WAY	Cover	.508
2.	3" BLIND	OK	.896
	2" NIPPLE	OK	.144
3.	1" NIPPLE	OK	NA
	1" COUPLING	OK	NA

CHECKED 8-12-87

SAFETY CONTROLS AND CONDITION:

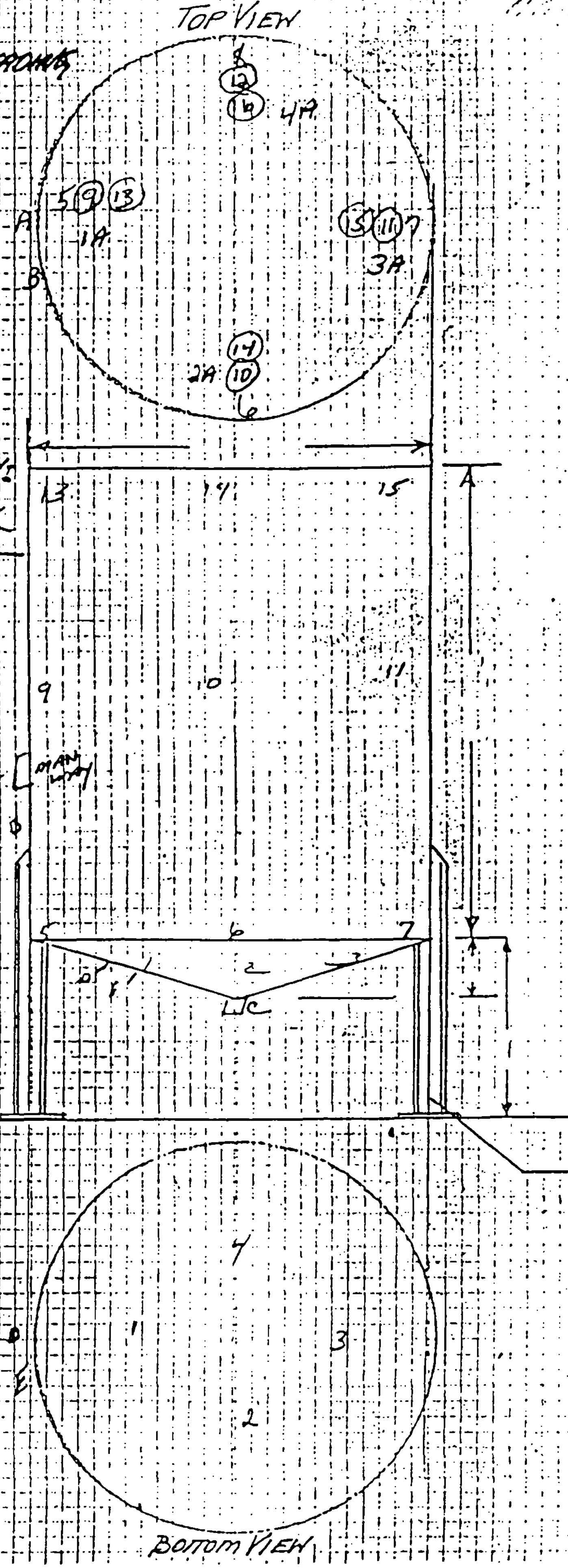
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL NONE

LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK



LEG DIAMETER:

NUMBER:

TANK: 1B

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL:

STR SIDE .090

PRINT	HEIGHT ABOVE STR. SIDE	READING
	CENTER OF CONE	.578
	"	.586
	"	.584
	"	.580
	BASE OF TANK	.420
	"	.417
	"	.432
	"	.423
	FIVE FEET UP TANK	.428
	"	.414
	"	.417
	"	.421
	TOP SIDE OF TANK	.390
		.388
		.390
		.394
	TOP OF TANK	.500
		.506
		.510
		.515

ANK IDENT: 116

OCATION: B

MAY 6, 1987

JUNE 10, 1986

OZZLES AND CONDITION; REMARKS

1. MAN WAY OK
2. NIPPLE OK 3
3. HT FLANG OK 3-?8

CHECKED 8-11-87

AFETY CONTROLS AND CONDITION:

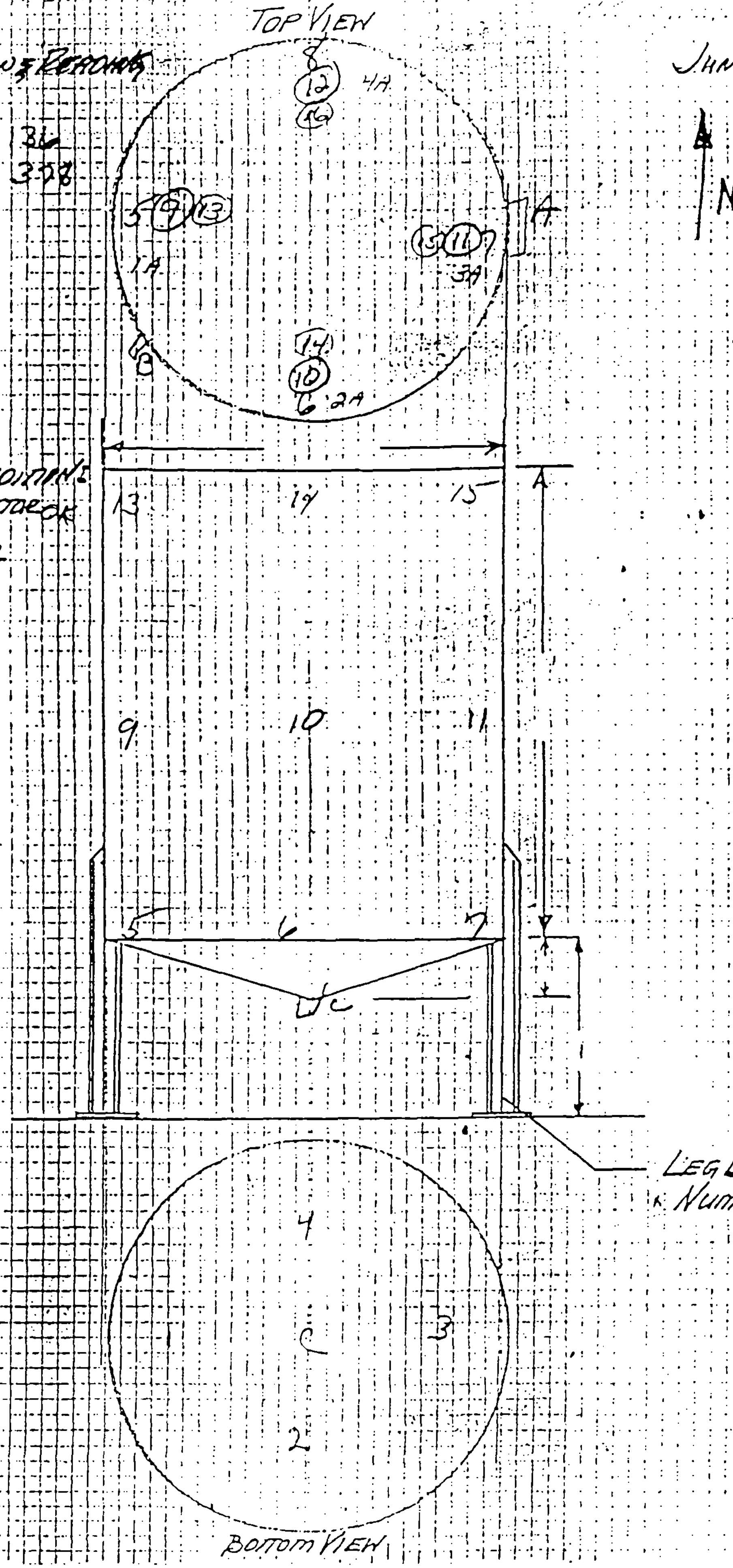
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

ESIGN STANDARDS:

AINT EXTERIOR: OK



LEG DIAMETER:

NUMBER:

TANK: 116

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL:

STR SIDE .093

PNT	HEIGHT ABOVE STR. SIDE	READING
	CENTER CONE	.284
	"	.285
	"	.300
	"	.273
	BASE OF TANK	.241
	"	.235
	"	.237
	"	.238
	FIVE FEET ABOVE BASE	.239
	"	.238
	"	.235
	"	.241
	Top Side of Tank	
	"	.240
	"	.240
	"	.240
	"	.245
	Top of Tank	
	"	.187
	"	.174
	"	.176
	"	.184

TANK IDENT: 117

LOCATION: B

MAR 7, 1986

JUNE 10, 1986

NOZZLES AND CONDITION & REMOUNT

NIPPLE .139

FLANGE .268

CHECKED 8-11-87

SAFETY CONTROLS AND CONDITION:

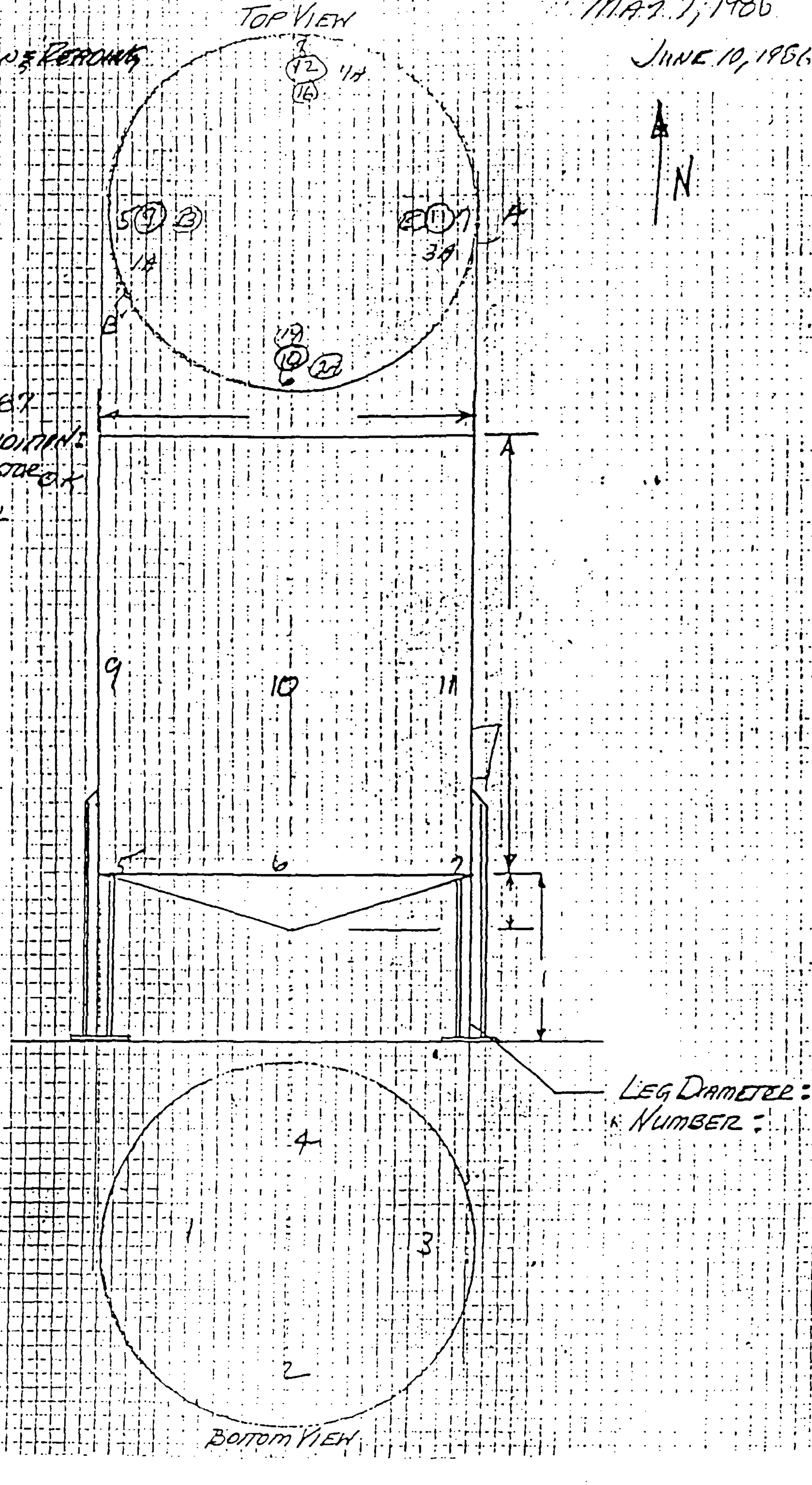
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

DESIGN STANDARDS:

EXTERIOR: OK



TANK: 117

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 7, 1987

MINIMUM WALL:

STR SIDE .093

PNT	HEIGHT ABOVE STR. SIDE	READING
	CENTER OF CONE	
	"	.314
	"	.313
	"	.314
	"	.311
	BASE OF TANK	.227
	"	.220
	"	.222
	"	.230
	FIVE FEET UP TANK	225
	"	230
	"	.226
	"	230
	Top Side of TANK	.224
	"	.208
	"	.226
	"	.215
	Top of TANK	.176
	"	.141
	"	.174
	"	.166

ANK IDENT: 117

CATION: RECLAIM CRUDE

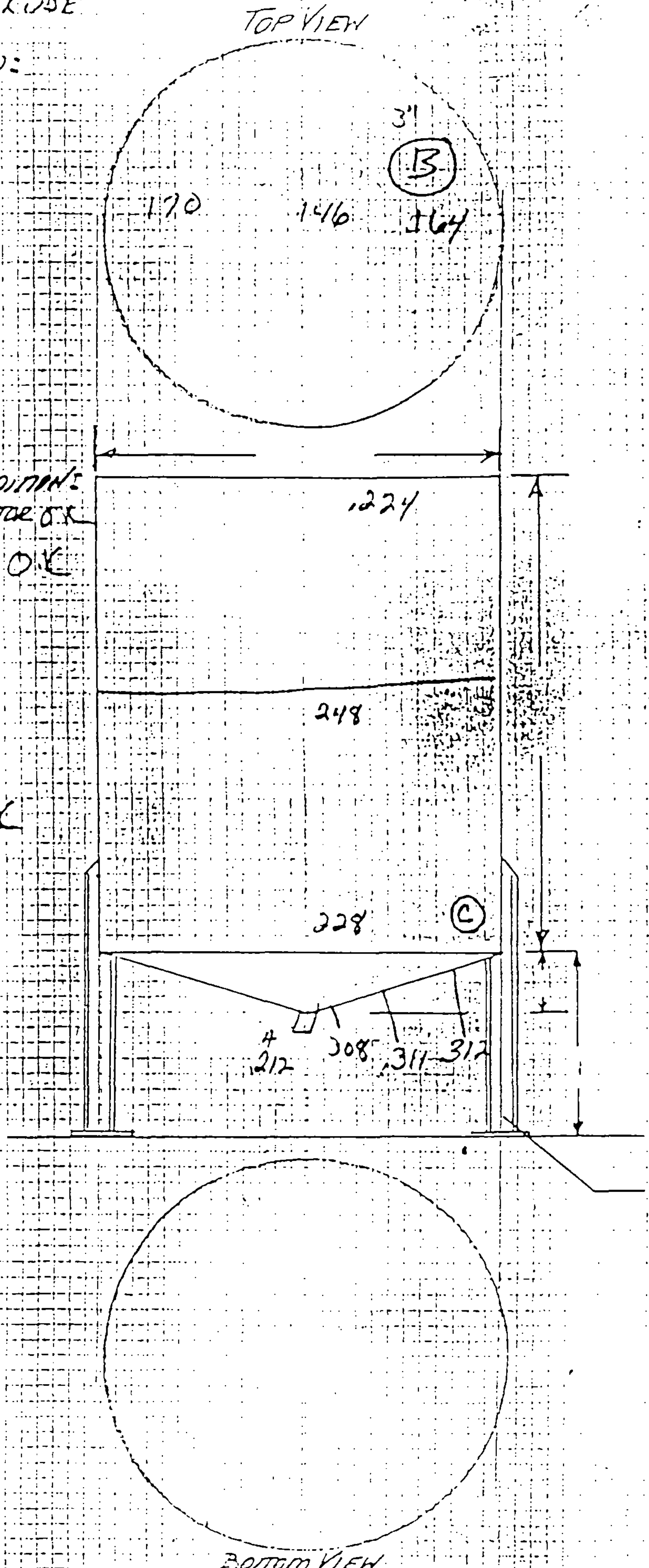
OZZLES AND CONDITION:

2 OK

235 O.K

O.K

JUNE 10, 1986



ETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR O.K

GAUGE AND LIQUID SEAL O.K

LEVEL ALARM O.K

ESIGN STANDARDS:

ANK EXTERIOR: O.K

LEG DIAMETER:

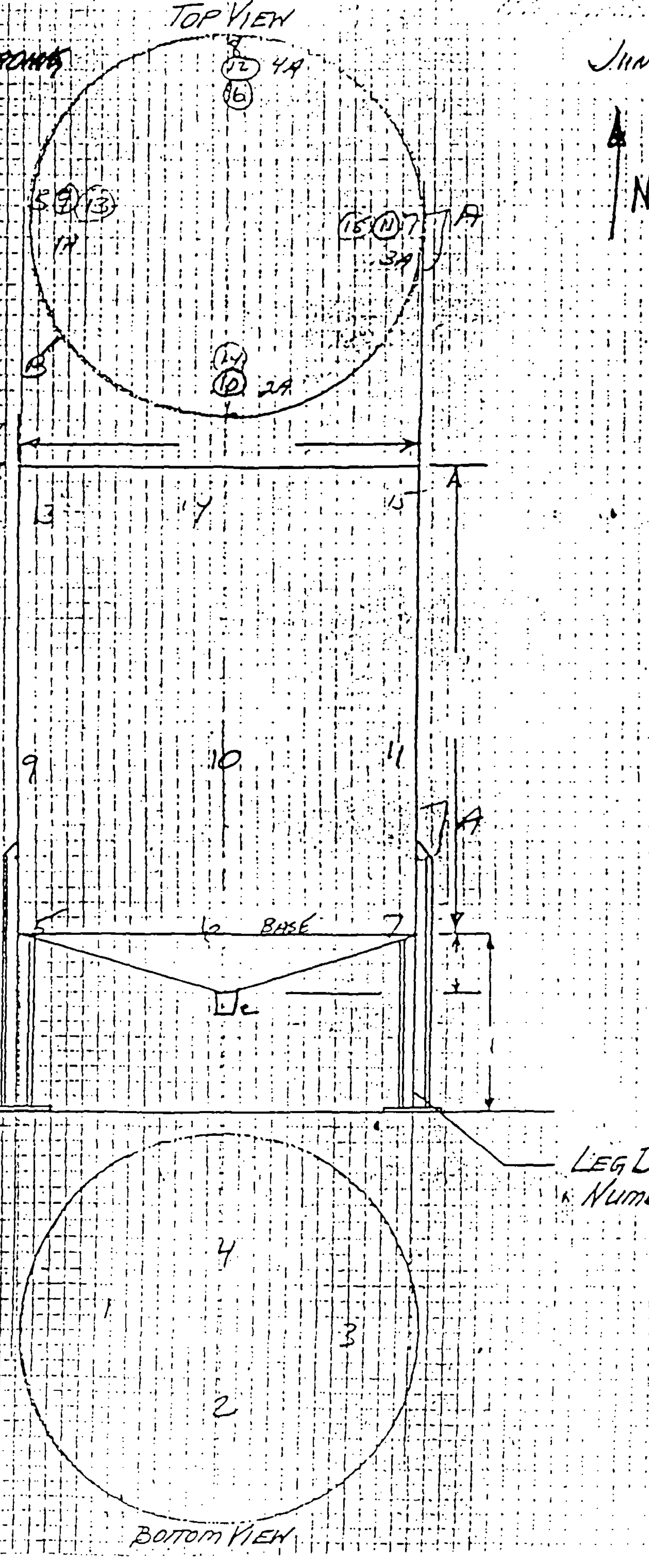
NUMBER:

ANK IDENT: 118 TANK PROFILE DATE: MAY ...

CATION: B

OZZLES AND CONDITION & [illegible]
MAN WAY OK
NIPPLE .143
" FLANG .233

JUNE 10, 1986



CHECKED 8-11-87

ETY CONTROLS AND CONDITIONS
BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL
OK FILLED
LEVEL ALARM OK

SIGN STANDARDS:

EXTERIOR: OK

LEG DIAMETER:
NUMBER:

TANK: 118

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 7, 1987

MAXIMUM WALL:

STR SIDE .093

NT

HEIGHT ABOVE STR. SIDE	READING
CENTER OF CONE	315
"	316
"	314
"	314
BASE OF TANK	234
"	226
"	.226
"	.230
FIVE FEET UP TANK	225
"	226
"	.220
"	.230
Top side of TANK	.230
"	.222
"	.235
"	.222
Top of TANK	.165
"	.149
"	.166
"	.146

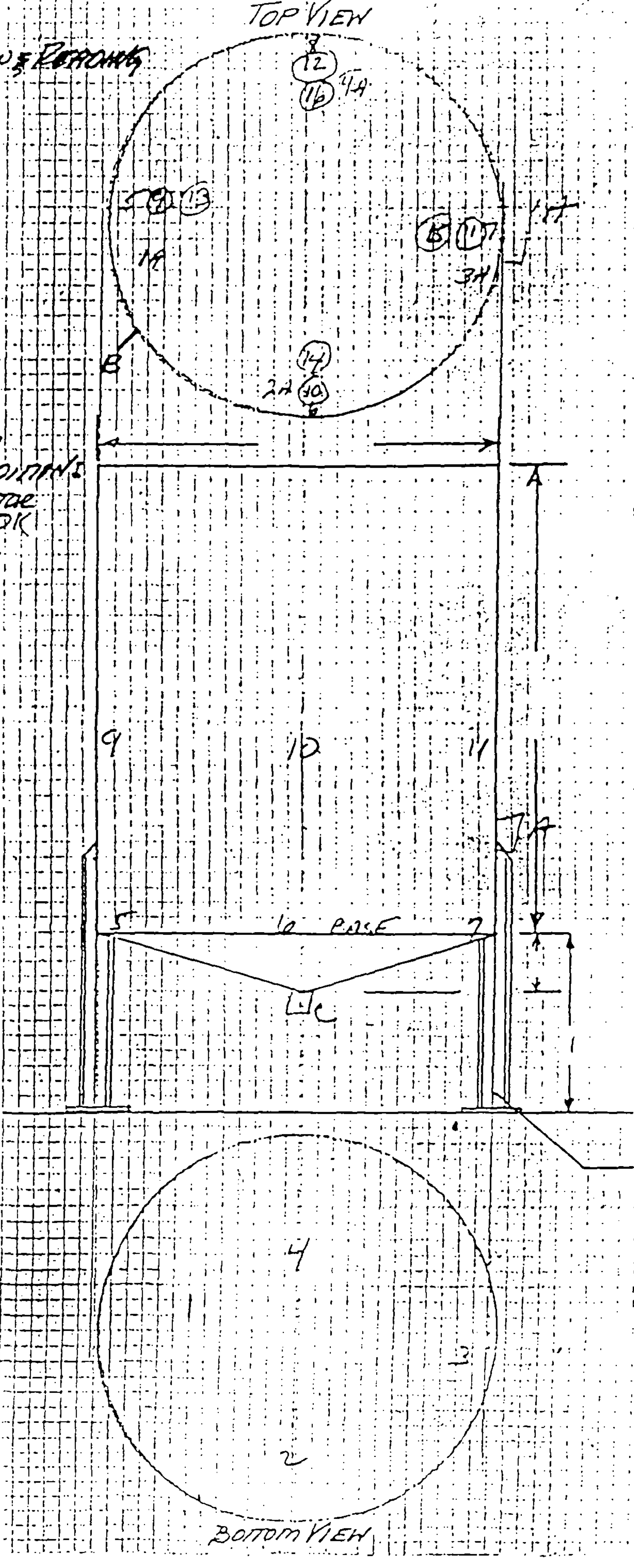
TANK IDENT: 119

TANK PROFILE

DATE: MAY 7, 1987

JUNE 10, 1986

xATION: B



ZZLES AND CONDITION & ~~REMARKS~~

MAN WAY OK

NIPPLE 148

4" FLANG 447

CHECKED 8-11-87

ETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL

OK FILLED

LEVEL ALARM OK

SIGN STANDARDS:

EXTERIOR: OK

LEG DIAMETER:

NUMBER:

TANK: 119

INSPECTOR: JOHN SPUDVILLE

DATE: MAR 17 1987

MINIMUM WALL:

STR SIDE .093

HEIGHT ABOVE STR. SIDE	READING
CENTER OF CONE	315
"	311
"	314
"	314
BASE OF TANK	.242
"	241
"	.244
"	.248
FIVE FEET UP TANK	236
"	241
"	.243
"	.234
Top Side of TANK	.244
"	.245
"	.239
"	.228
Top of TANK	.181
"	.183
"	.180
"	.180

NK IDENT: 120

TANK PROFILE

DATE:
MAY 6, 1987

XATION: B

JUNE 10, 1986

ZZLES AND CONDITION & READING
2N. WAY OK .249
NIPPLE OK .136
2" NIPPLE OK .134

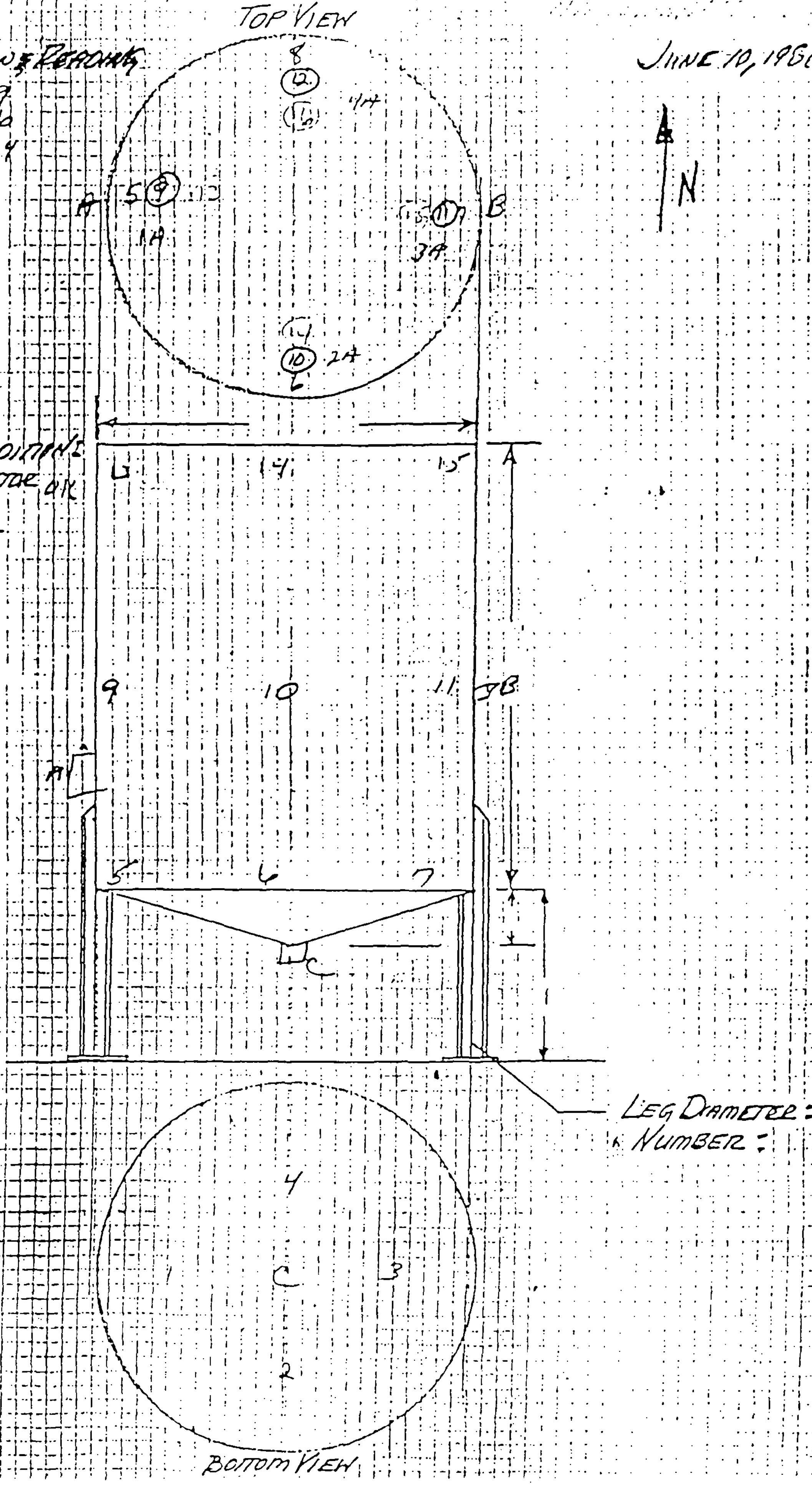
CHECK 8-12-87

TY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR OK

AUGE AND LIQUID SEAL
OK FILLED
LEVEL ALARM OK

SIGN STANDARDS:

K EXTERIOR: OK



TANK: 120

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL:

STR SIDE .070

HT	HEIGHT ABOVE STR. SIDE	READING
	CENTER OF CONE	.306
	"	.305
	"	.307
	"	.303
	BASE OF TANK	.246
	"	.250
	"	.242
	"	.248
	SIX FEET ABOVE BASE	.236
		.235
		.238
		.252
	TOP SIDE OF TANK	.222
		.212
		.216
		.212
	TOP OF TANK	.116
		.129
		.121
		.113

NK IDENT: 120

TANK PROFILE

DATE: 4-18-86

CATION: RECLAIM CRUDE

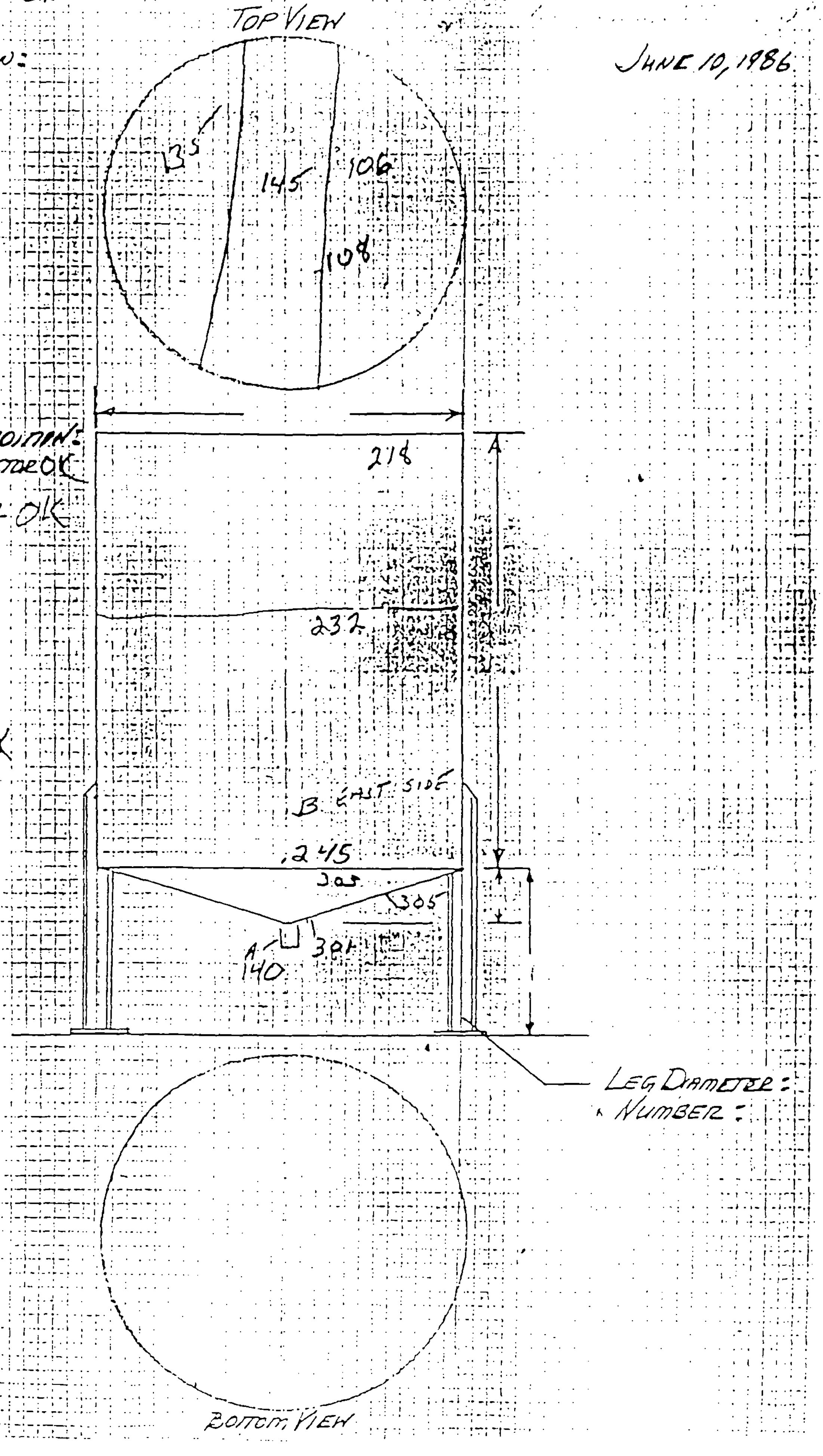
JUNE 10, 1986

ZZLES AND CONDITION:
IO OK
O OK

TY CONTROLS AND CONDITION:
REATHER AND 2" ARRESTOR OK
AUGE AND LIQUID SEAL OK
EVEL ALARM OK

SIGN STANDARDS:

L EXTERIOR: O.K



TANK IDENT: 121   TANK PROFILE   DATE: 9-18-86

CATION: RECLAIM CRUDE

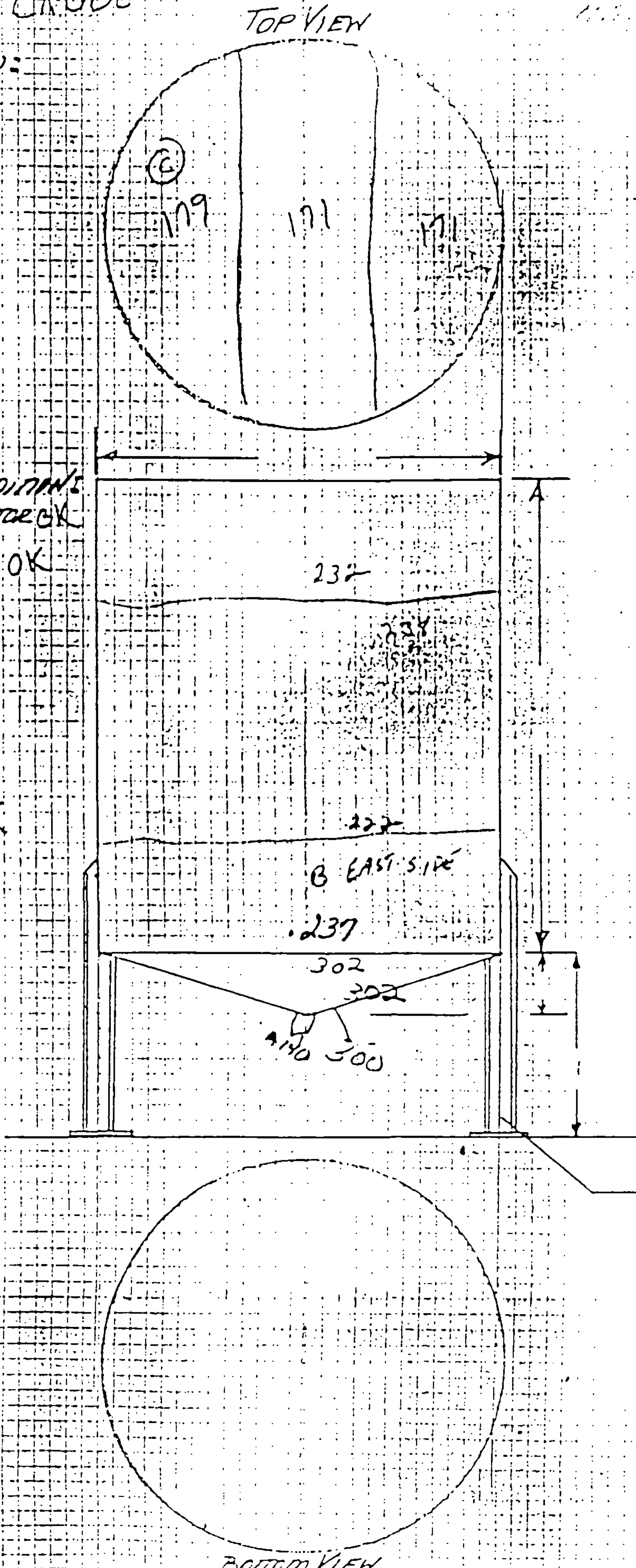
JUNE 10, 1986

ZZLES AND CONDITION:

2   OK

1 1/2   OK

OK



ETY, CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK

LEVEL ALARM OK

SIGN STANDARDS:

EXTERIOR: OK

LEG DIAMETER:

NUMBER:

TANK 121

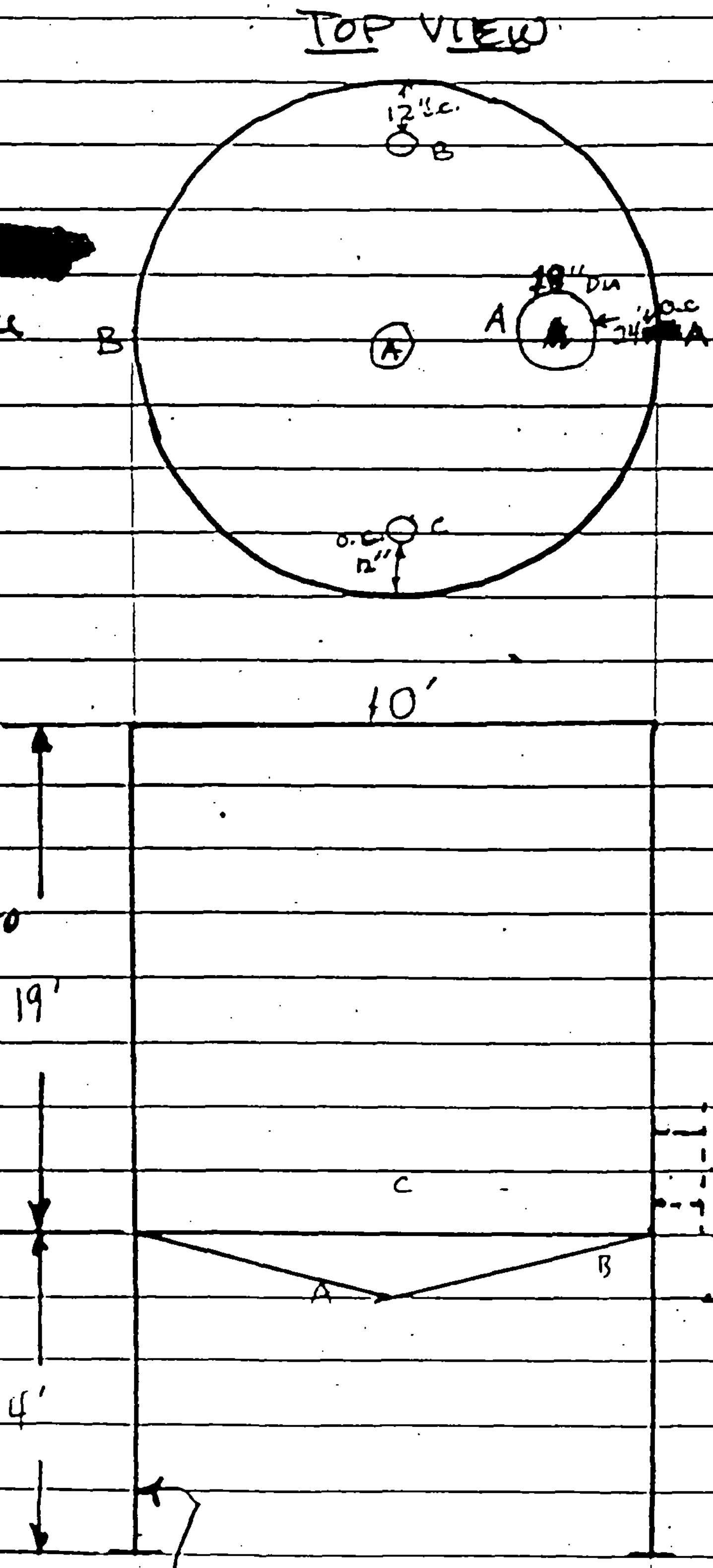
NOTES - [redacted]

LOCATE SIDE WALL FITTINGS IN TOP VIEW

LOCATE GAGE IN TOP VIEW

LOCATE RISER SIDE IF ATTACHED

LOCATE BOTTOM FITTINGS IN TOP VIEW WITH CIRCLED LETTER



TOP FITTINGS.

SIZE	USE
A.	MANHEAD W/GAU
B. 2"	VENT
C. 2"	CAP
D.	

BOTTOM FITTINGS

	SIZE	USE
A.	3"	
B.		
C.		
D.		

SIDE WALL FITTIN

	SIZE	ABOVE SE
A.	2"	3"
B.	MANHEAD	
C.		
D.		

MANHEAD DIAM 2

27 JUNE 85

THICKNESS READIN

A. .300

B. .305

C. .231

LEG SIZE 8" x 8"

TANK PROFILE

DATE: MAY 6, 1987

JUNE 10, 1986

TANK IDENT: 121

LOCATION: B

NOZZLES AND CONDITION & READINGS

A. MANWAY OK .244

B. 3" NIPPLE OK .136

C. 2" NIPPLE OK .135

F.

I.

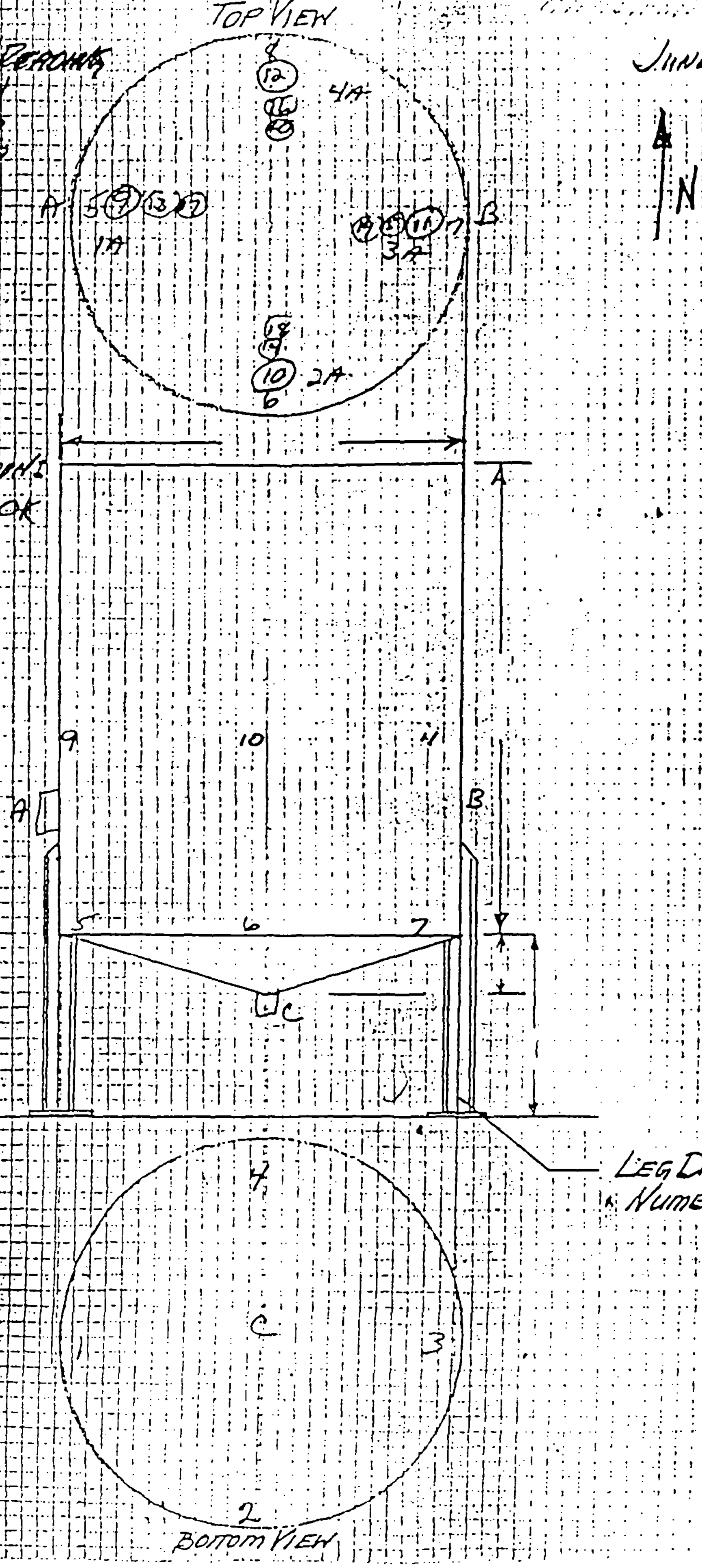
CHECKED 8-12-87

SAFETY CONTROLS AND CONDITION:

1. BREATHER AND 2" ARRESTOR OK
2. GAUGE AND LIQUID SEAL OK FILLED
3. LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK



LEG DIAMETER:

NUMBER:

TANK: 121

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL:

STR SIDE .120

INT	HEIGHT ABOVE STR. SIDE	READING
	CENTER OF COVE	.305
	"	.309
	"	.304
	"	.304
	BASE OF TANK	.240
	"	.249
	"	.239
	"	.244
	SIX FEET ABOVE BASE	.232
	"	.236
	"	.230
	"	.236
	12 FT. Above Base	.243
		.238
		.244
		.238
	Top Side of Tank	.213
		.230
		.243
		.225
	Top of Tank	.175
		.176
		.175
		.172

TANK PROFILE

DATE: MAY 6, 1987

TANK IDENT: 122

LOCATION: B

NOZZLES AND CONDITION & ~~REMARKS~~

MANWAY	OK	.241
NIPPLE	OK	.151
2" NIPPLE	OK	.134

JUNE 10, 1986

CHECK 8-12-87

SAFETY CONTROLS AND CONDITIONS:

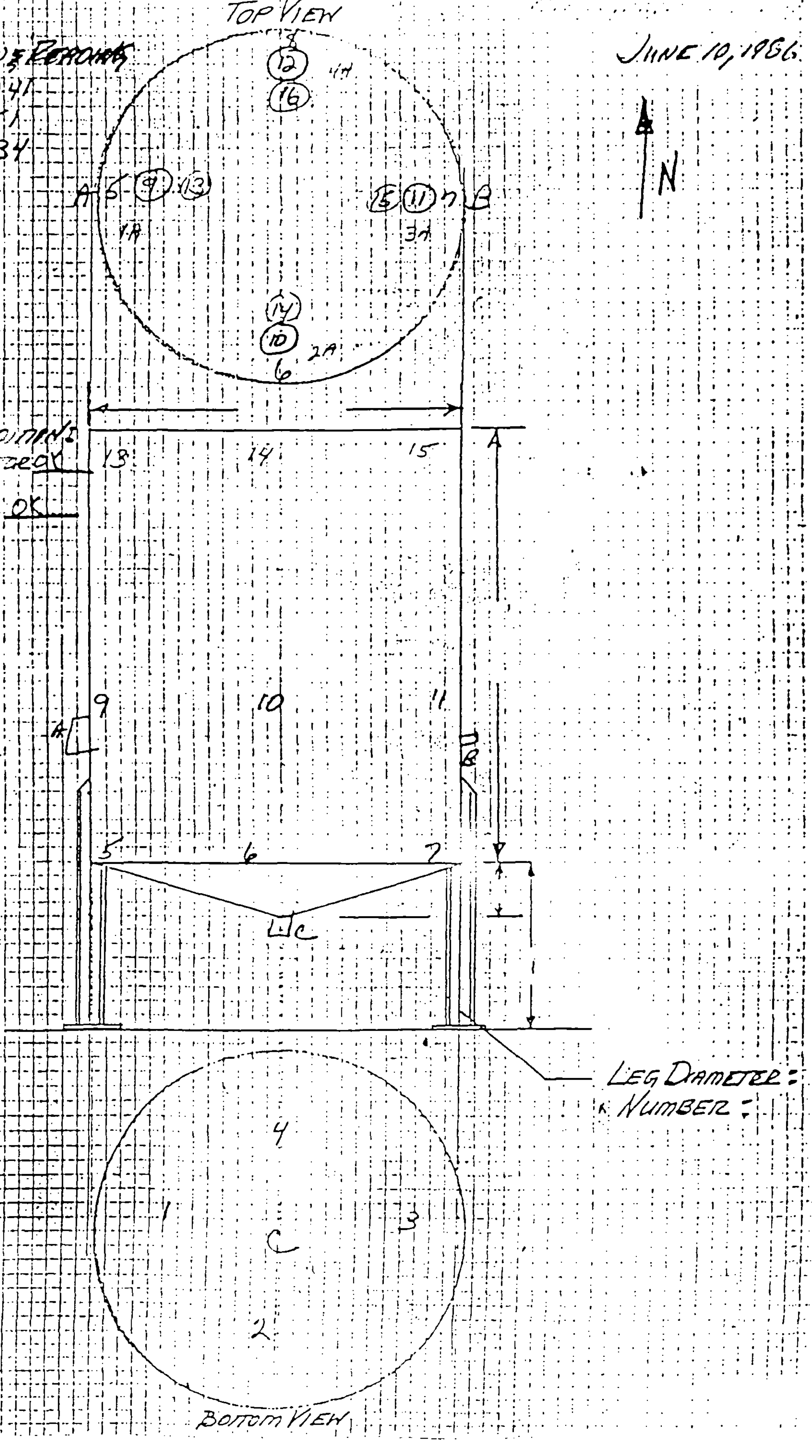
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK

FILLER LEVEL ALARM OK

DESIGN STANDARDS:

EXTERIOR: OK



TANK: 122

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 6, 1987

MINIMUM WALL:

STR SIDE .120

HEIGHT ABOVE STR. SIDE	READING
CENTER OF CONE	.307
"	.309
"	.307
"	.310
BASE OF TANK	.249
"	.247
"	.249
"	.250
SIX FEET ABOVE BASE	.242
"	.237
"	.243
"	.236
Twelve Feet Above Base	.248
"	.228
"	.235
"	.236
Top Side of Tank	.206
"	.201
"	.192
"	.218
Top of tank	.116
"	.112
"	.125
"	.110

TANK PROFILE

DATE: 9-18-86

NK IDENT: 122

ATION: RECLAIM CRUDE

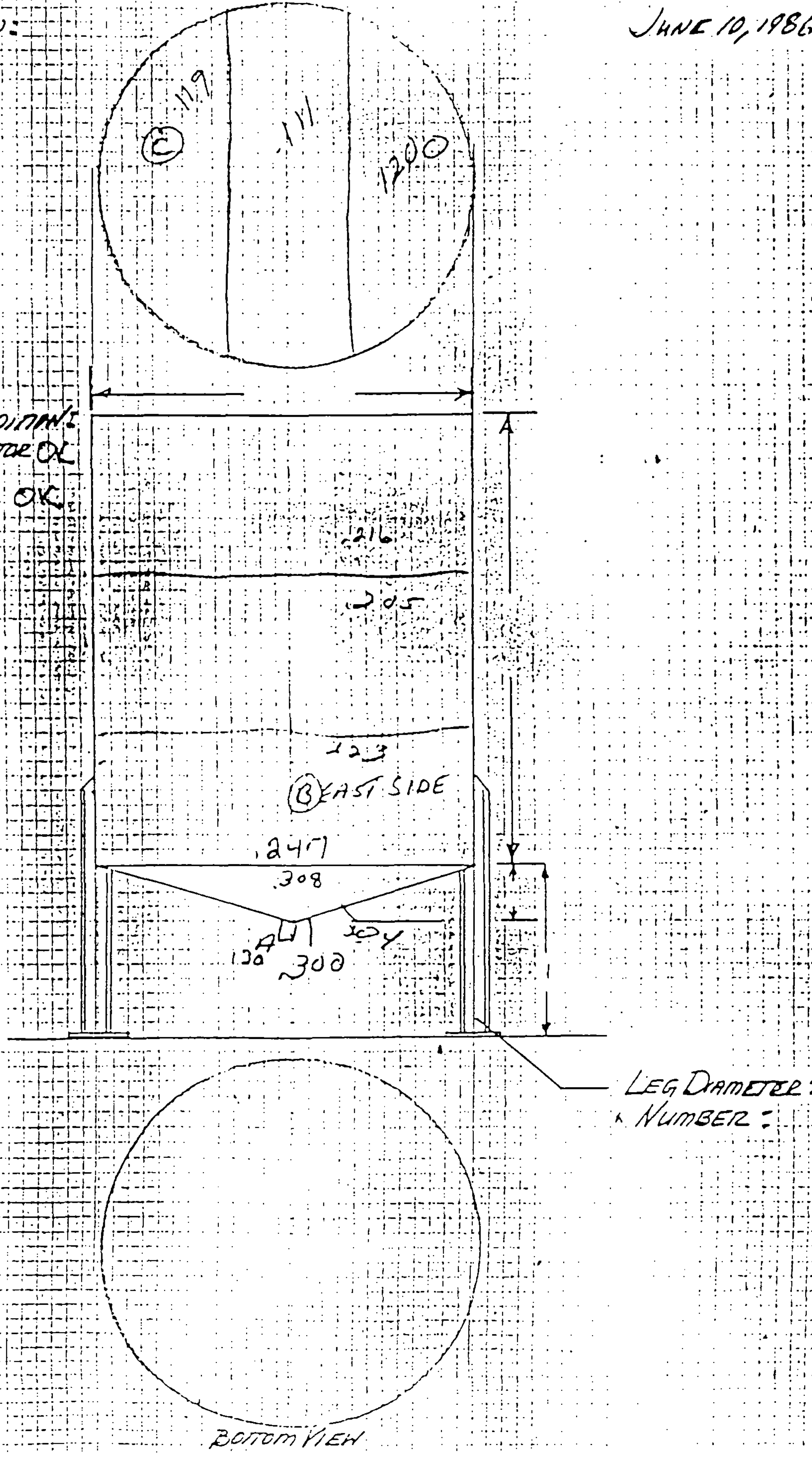
June 10, 1986

ZZLES AND CONDITION:

3 OK

B - OK

TOP VIEW



ETY CONTROLS AND CONDITION:

REATHER AND 2" ARRESTOR OK

AUGE AND LIQUID SEAL OK

LEVEL ALARM OK

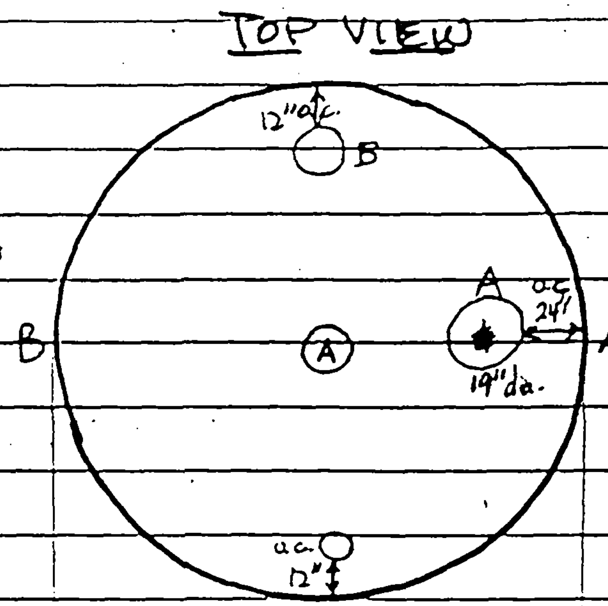
SIGN STANDARDS:

NK EXTERIOR: OK

BOTTOM VIEW

TANK 122

TOP VIEW



A
N

[redacted]

NOTES –
LOCATE SIDE WALL FITTINGS IN TOP VIEW

LOCATE GAGE IN TOP VIEW

LOCATE RISER TYPE OF ATTACHED

LOCATE BOTTOM FITTINGS IN TOP VIEW WITH CIRCLED LETTER

TOP FITTINGS

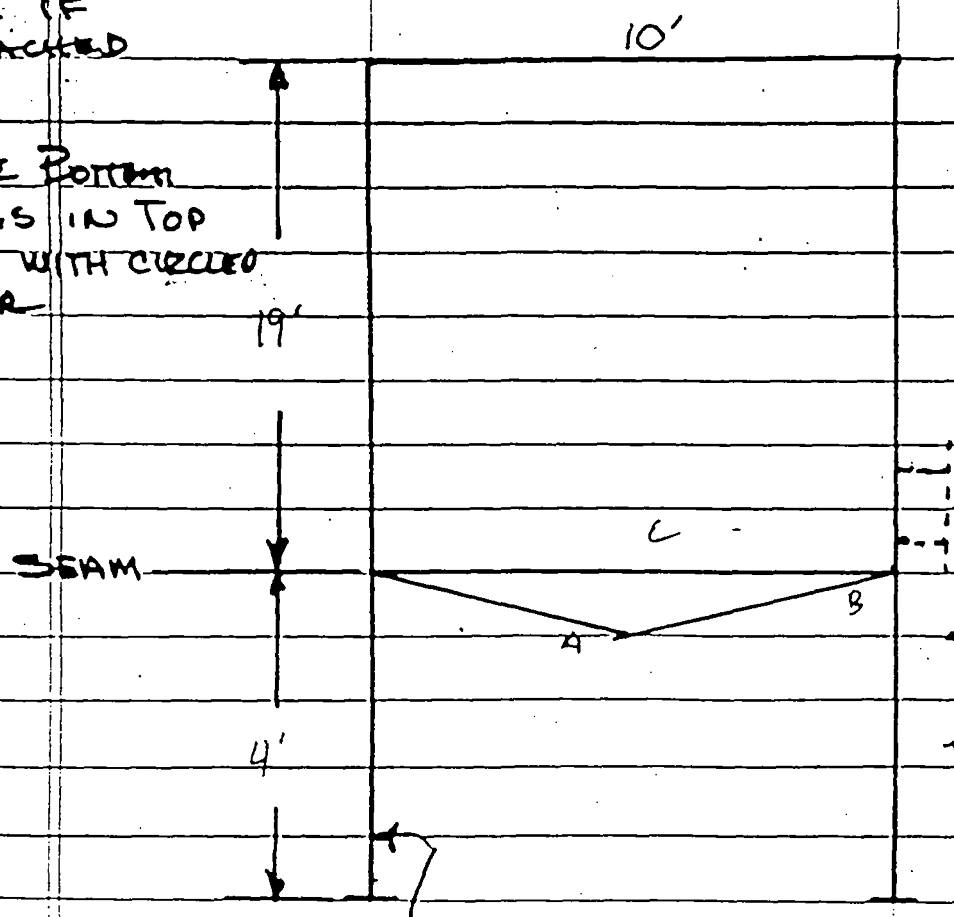
SIZE	USE
A.	MANHEAD W/GA
B. 2"	VENT
C. 2"	CAP
D.	

BOTTOM FITTINGS

SIZE	USE
A. 3"	
B.	
C.	
D.	

SIDE WALL FITTIN

SIZE	ABOVE SE
A. 2"	3"
B. MANHEAD	
C.	
D.	



MANHEAD DIAM 22"

22 JUNE 85

THICKNESS READIN

A. .310
B. .309
C. .252

LEG SIZE 8" X 8"

TANK PROFILE

DATE: MAY 7, 19??

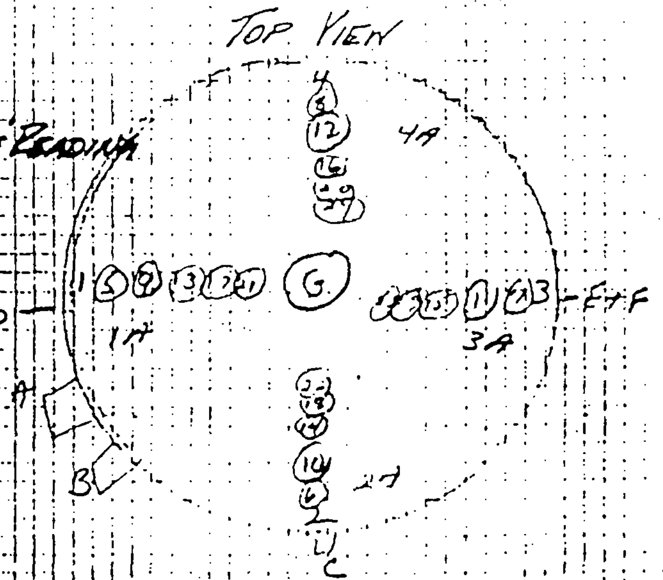
JUNE 10, 1986

TANK IDENT: 123

LOCATION: 8

NOZZLES AND CONDITION; READING

1. MAN WAY
2.
 2" NIPPLE .256
D. 3" NIPPLE .204
 2" " .143
F. 2" " .142
 MANWAY



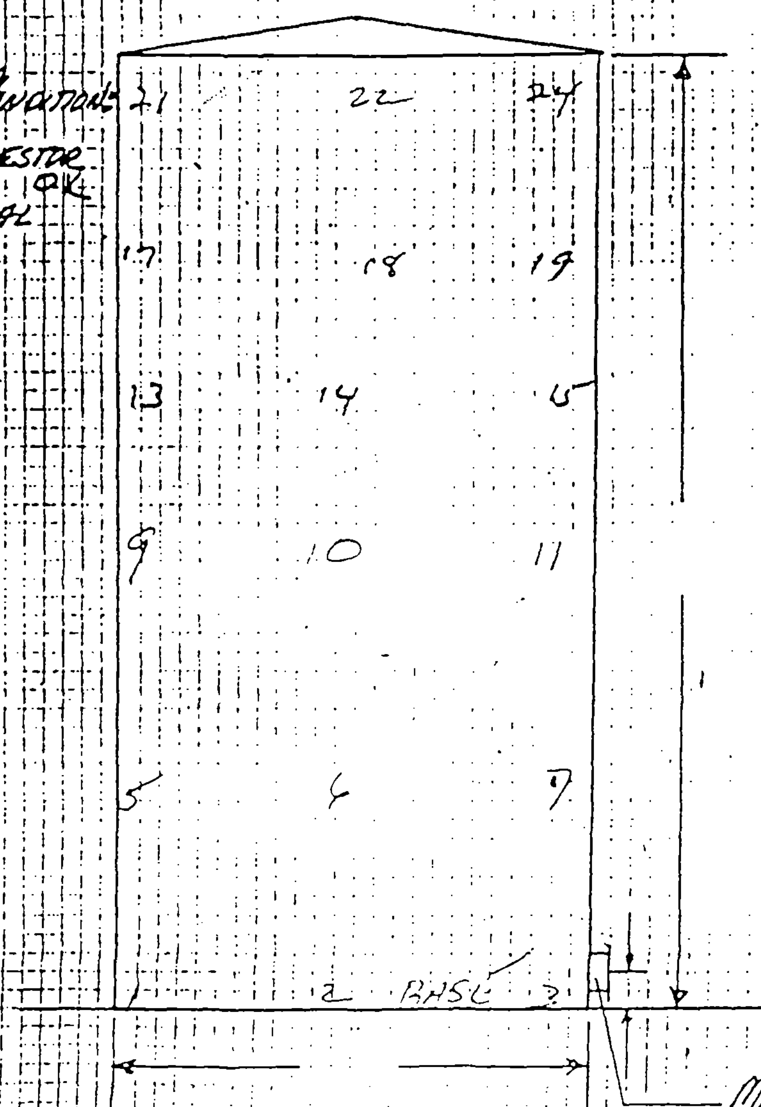
CHECKED 8-12-87

SAFETY CONTROLS AND CONDITION

1 BREATHER AND 2" ARRESTOR OK
2 GAUGE AND LIQUID SEAL O.K FILLED
3 LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK



TANK: 123

INSPECTOR: John Spudville

DATE: MAY 7, 1987

MINIMUM WALL:

STR SIDE .143

HEIGHT ABOVE STR. SIDE	READING
BASE OF TANK	.243
"	.239
"	.240
"	.245
SIX FEET UP	.240
"	.243
"	.240
"	.241
12' UP	.246
"	.247
"	.248
"	.248
18' UP	.246
	.243
	.248
	.252
24' UP	.244
	.250
	.242
	.250
TOP SIDE OF TANK	.244
	.245
	.241
	.247
TOP OF TANK	.270
	.268
	.278
	.265

TANK PROFILE

DATE: 9-22-86

JUNE 10, 1986

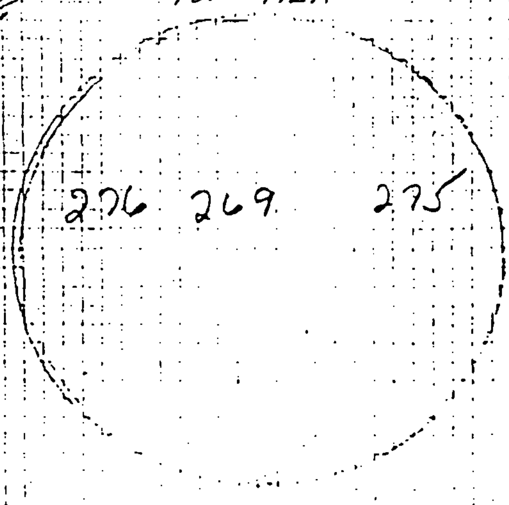
TANK IDENT: 123

LOCATION: RECLAIM CRUDE

NOZZLES AND CONDITION:

A. O.K
B. O.K
C. OK
D. O.K
E. All VENT LINES
F.
G. VISUAL OK
H. (123 - 124)
I.
J.

TOP VIEW

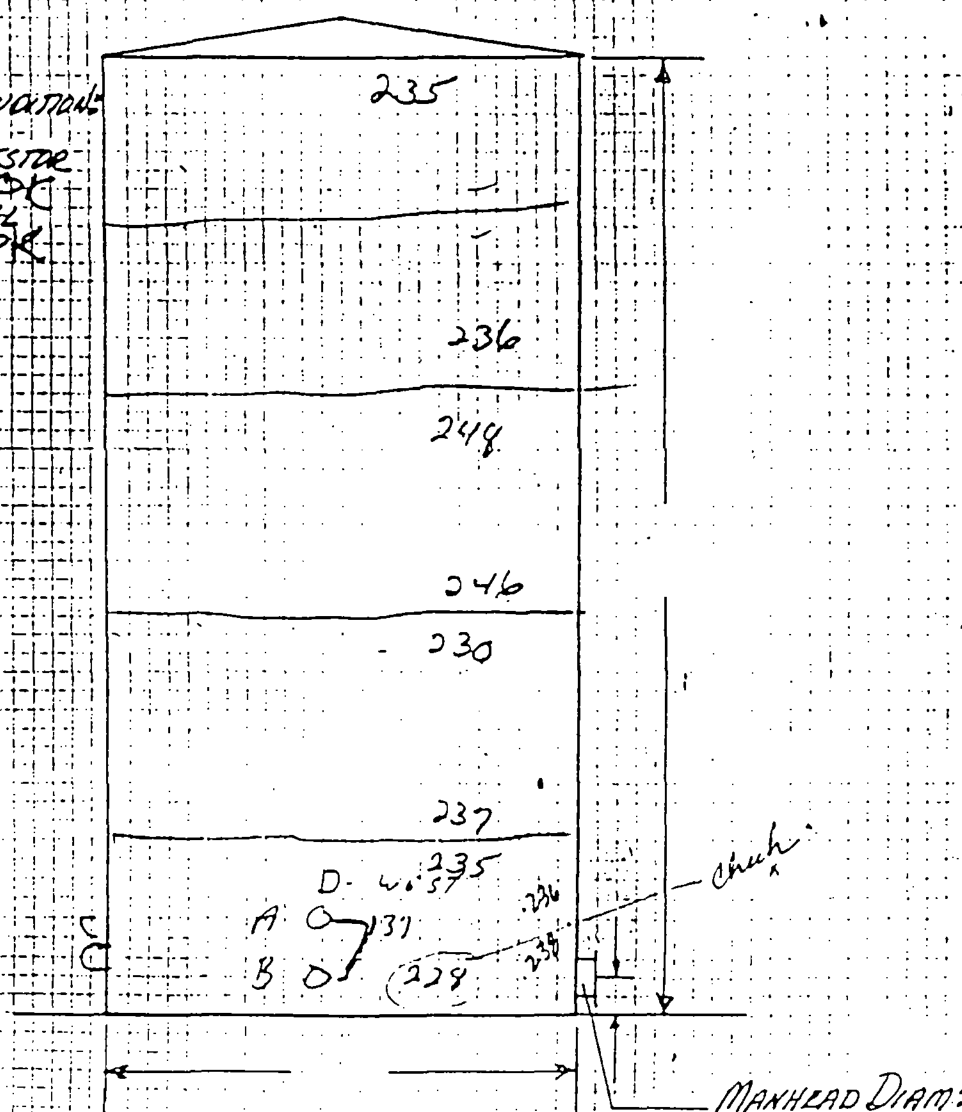


SAFETY CONTROLS AND CONDITION:

1. BREATHER AND 2" ARRESTOR OK
2. GAUGE AND LIQUID SEAL OK
3. LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: O.K



TANK 123

N

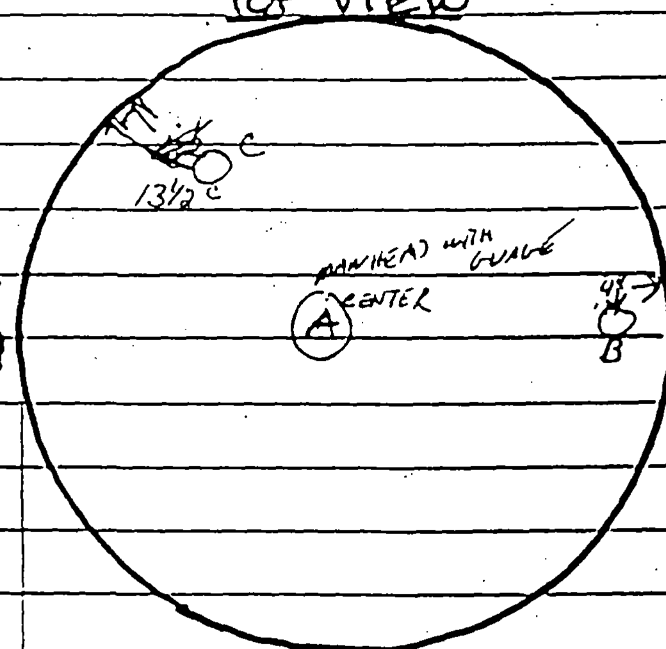
TES—
ATE SIDE W [redacted]
TINGS IN TOP
EW

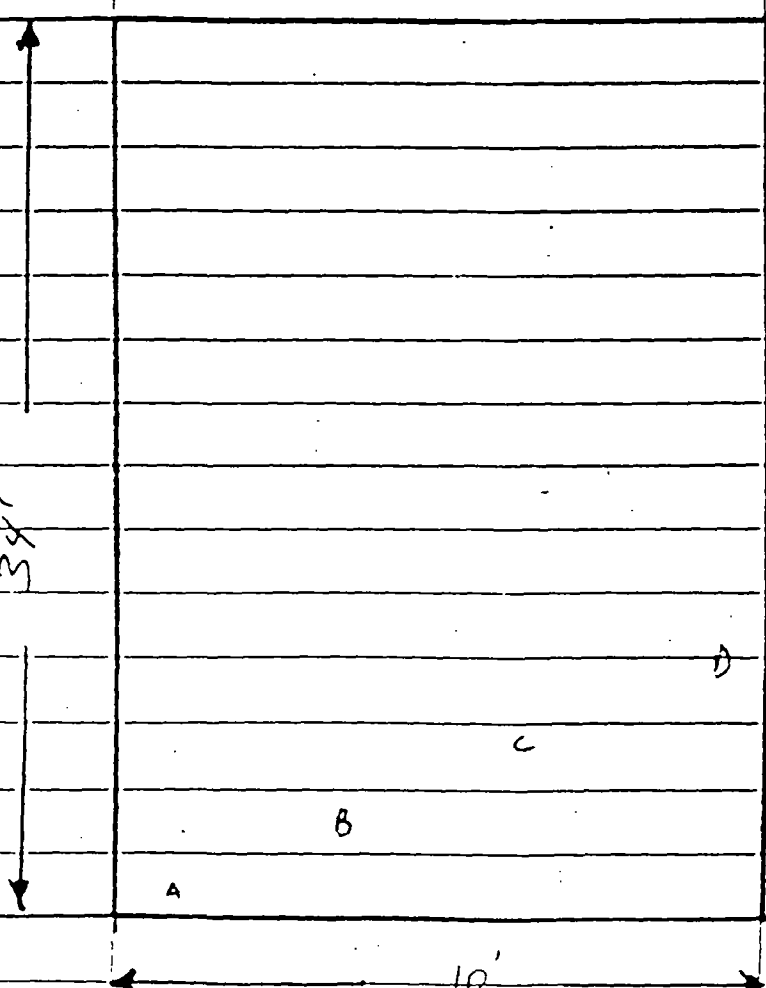
OCATE GAGE
TOP VIEW

CATE RISER
DE IF
TACHED

TE CATWALK

TOP VIEW





TOP FITTINGS

	SIZE	USE
A.	21" D.	MAN.H
B.	3"	VEW
C.	2"	CAP.
D.		

22 JUNE 85

THICKNESS READ

A.	.214
B.	.264
C.	.267
D	.249

SIDE WALL FITTI

	SIZE	ABOVE
A.	~~2"~~	24" ~~CAP~~
B.	3"	13 FROM TO. CAP
C.	2"	7"
D.	2"	19"
E.	3"	12"
F	21" MANHEAD	24"
G	8" MONITOR	23"
H	2"	5"

MANHEAD
DIAM

TANK PROFILE

DATE:

MAY 8. 1987

JUNE 10, 1986

TANK IDENT: 124

LOCATION: 3

NOZZLES AND CONDITION & READING

MAN WAY .217

AGITATOR .312

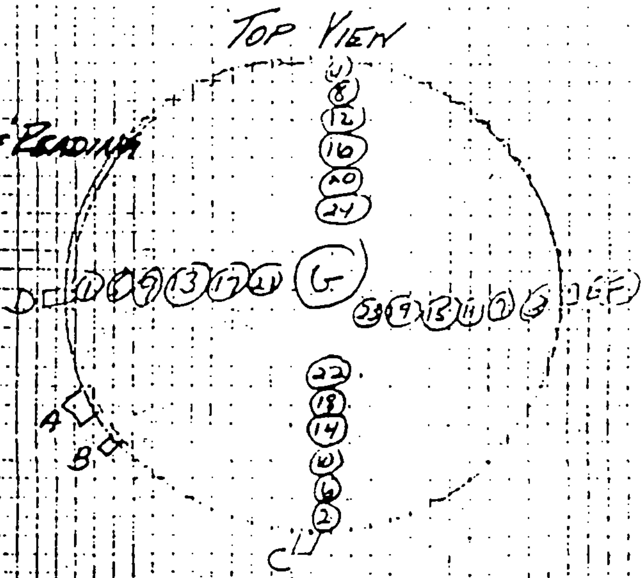
2" NIPPLE .250

3" NIPPLE .206

2" NIPPLE .143

2" NIPPLE .131

MAN WAY



CHECKED 8-12-87

CONTROLS AND CONDITION

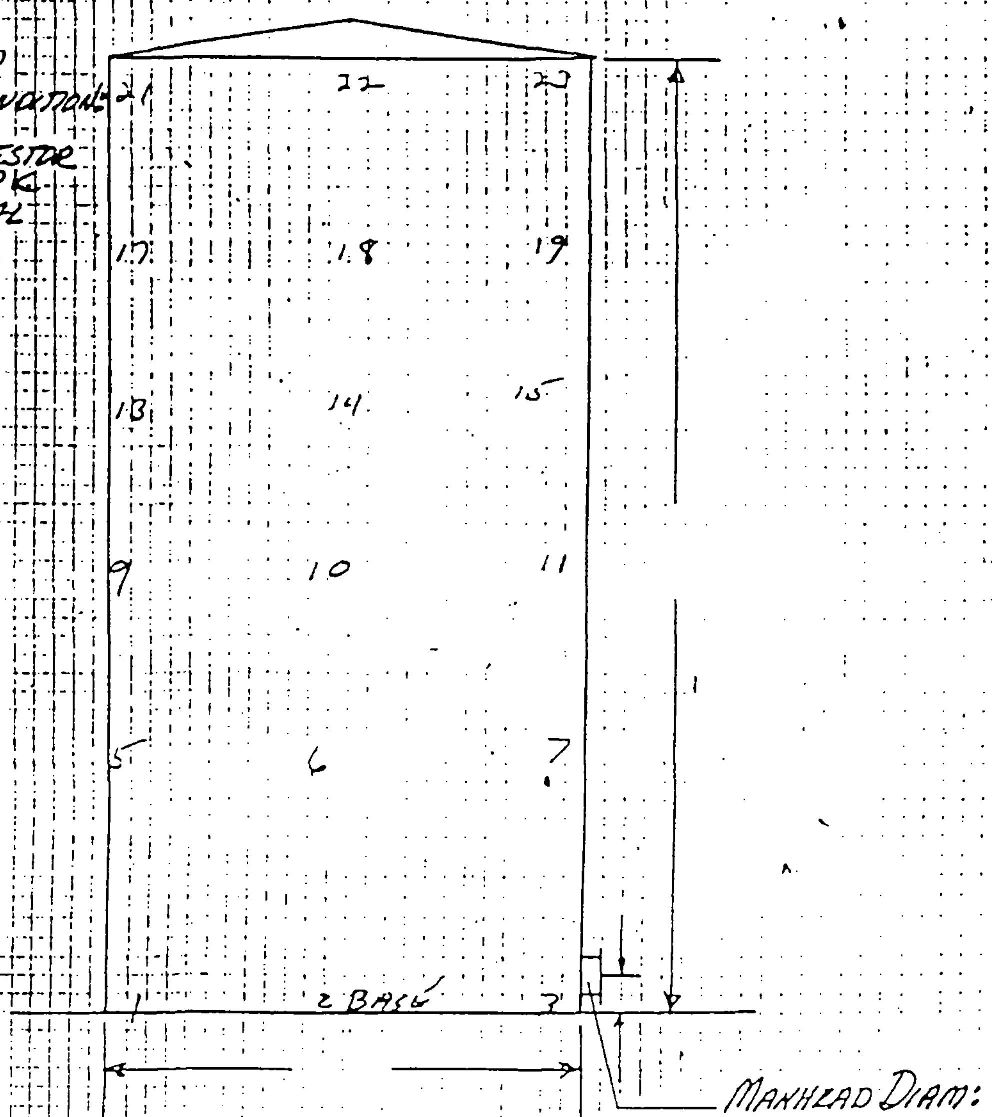
BREATHER AND 2" ARRESTOR OK OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK



TANK: 124

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

STR SIDE .143

HEIGHT ABOVE STR. SIDE	READING
BASE	.243
"	.247
"	.243
"	.247
SIX FEET UP	.244
	.241
	.236
	.248
TWELVE FEET UP	.248
	250
	.251
	.247
18' UP	.238
	.239
	.240
	.233
24' UP	244
	240
	.245
	244
TOP SIDE OF TANK	.250
	.256
	.252
	.250
TOP OF TANK	265
	.270
	.262
	.270

TANK PROFILE DATE -9-22-86

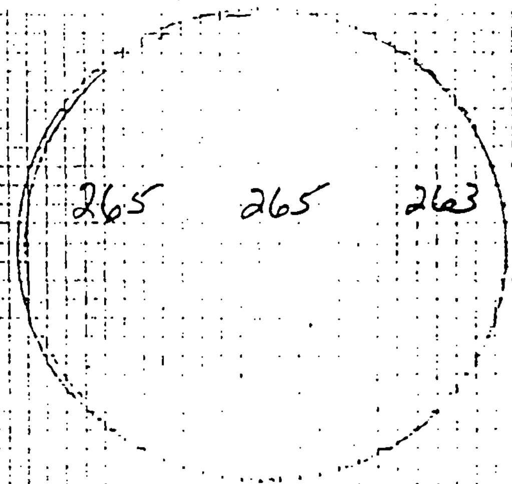
ANK IDENT: 124

OCATION:

JUNE 10, 1986

LES AND CONITION:
OK
OK
OK
OK

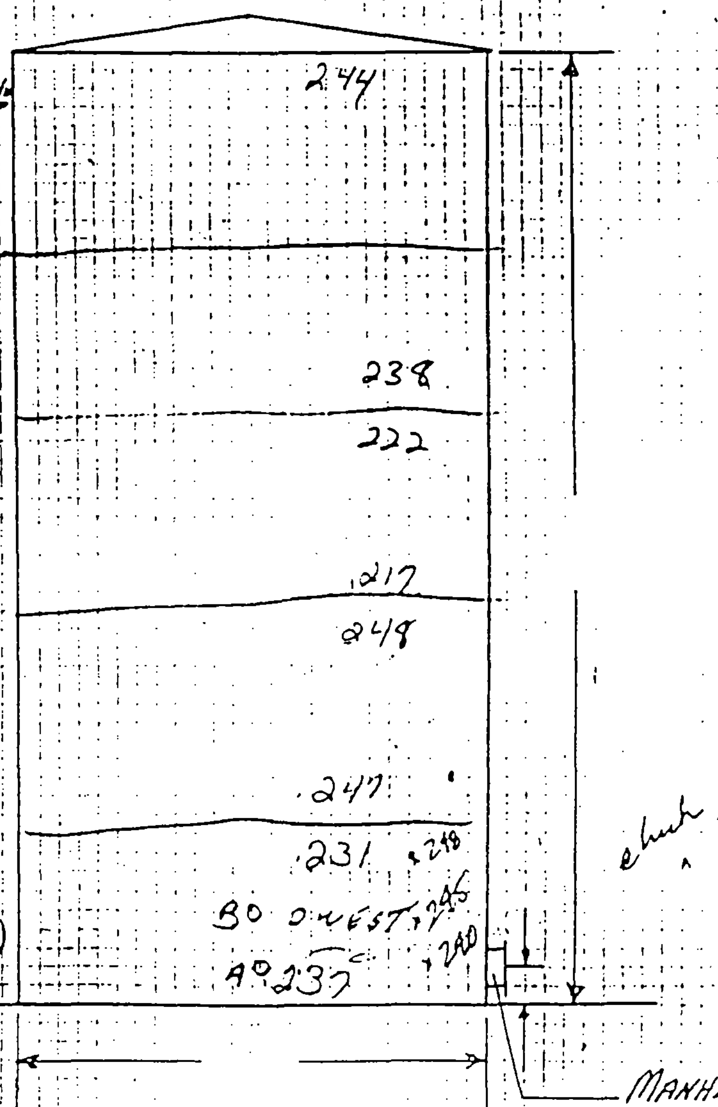
TOP VIEW



FETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL OK
LEVEL ALARM OK

ESIGN STANDARDS:

NK EXTERIOR: OK



MANHEAD DIAM:

TANK 124

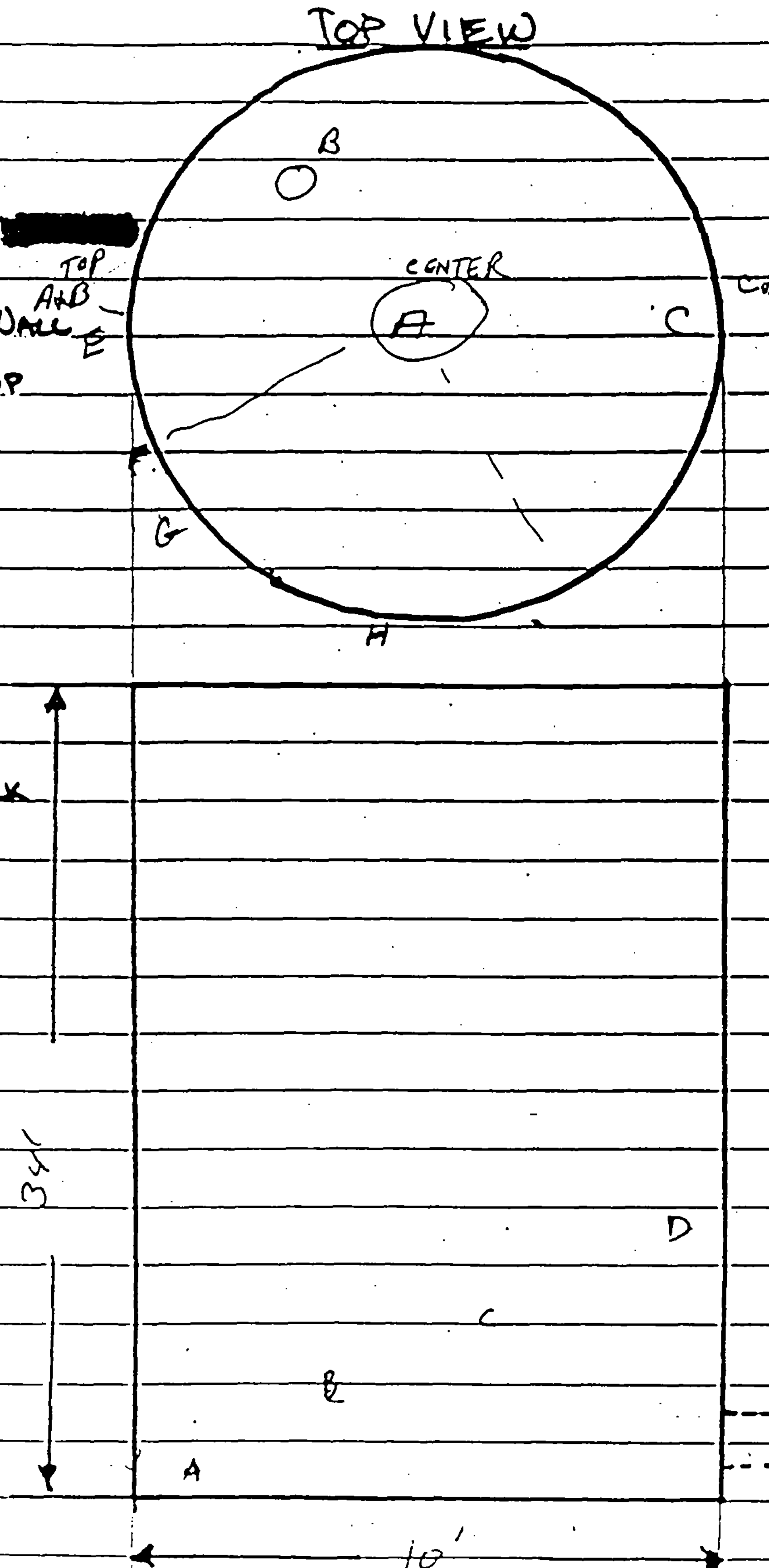
[redacted]

ES—

ATE SIDEWALL
TINGS IN TOP
W

ATE GAGE
TOP VIEW

ATE RISER
PE IF
ACHED
ATE CATWALK



TOP FITTINGS

SIZE	USE
A. 21"	MANHE
B. 2"	CAP
C. 3"	VENT
D.	

27 June 85

THICKNESS READIN

A. .229
B. .262
C. .260
D .242

SIDE WALL FITTI

SIZE	ABOVE
A. ~~3"~~ CAP	24" from
B. 3"	13" from
C. 2"	6½
D. 2"	18½
E. 3"	12½
F 21" man head	24"
G ~~ton~~ rack 8"	26'
H 2"	6"

MANHEAD
DIAM

TANK PROFILE

MAY 12, 1987

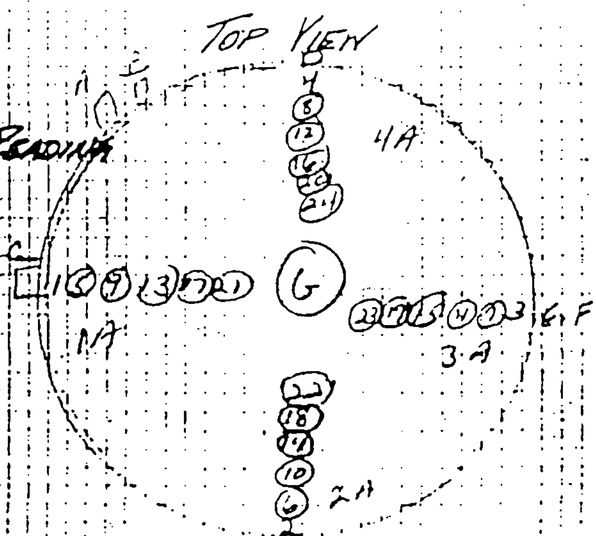
ANK IDENT: 125

OCATION: B

JUNE 10, 1986

ZLES AND CONDITION & READING

MAN WAY 212
AGITATOR 306
3" NIPPLE .200
2" NIPPLE .136
2" NIPPLE .146
2" NIPPLE .147
MAN WAY

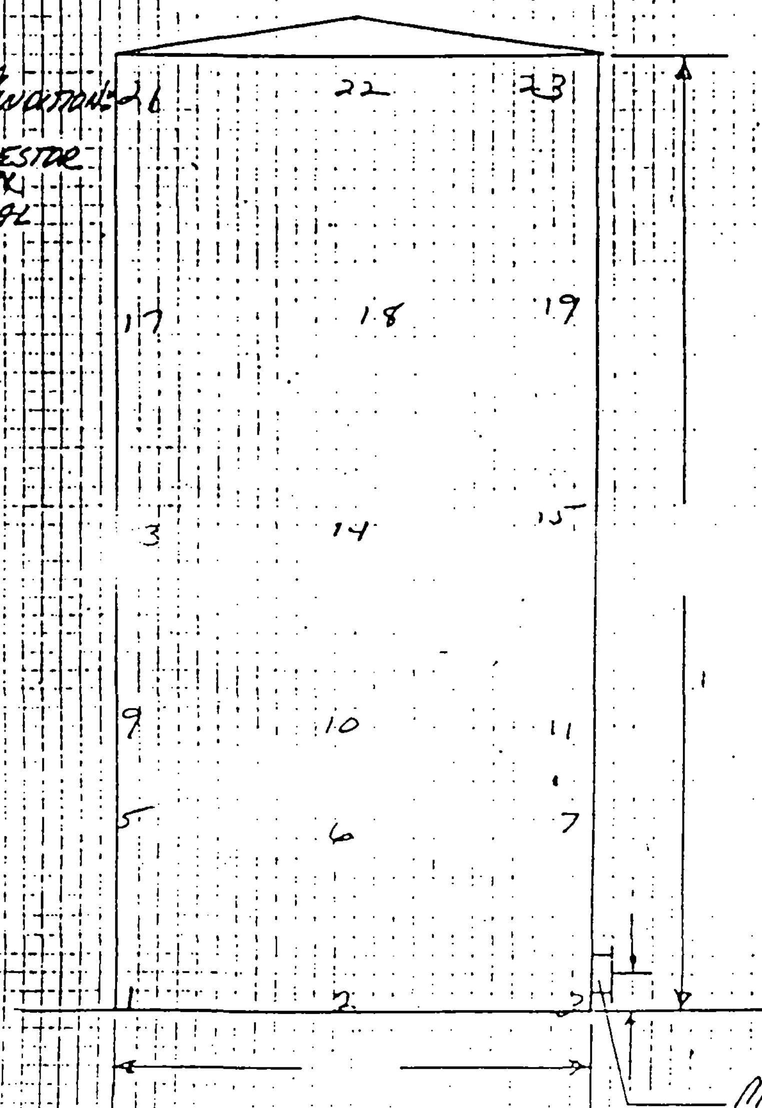


N

CHECKED 8-12-87
FETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL OK FILLED
LEVEL ALARM OK

ESIGN STANDARDS:

NK EXTERIOR: OK



MANHEAD DIAM:

TANK: 125

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

STR SIDE .143

VT

HEIGHT ABOVE STR. SIDE	READING
BASE	.246
"	.241
"	.236
"	.239
SIX FEET UP	.240
"	.240
"	.236
"	.238
TWELVE FEET UP	.240
	.238
	.238
	.239
18' UP	.240
	.241
	.243
	.240
24' UP	.242
	.246
	.244
	.242
TOP SIDE OF TANK	.225
	.233
	.225
	.224
TOP OF TANK	.285
	.286
	.290
	.298

TANK PROFILE DATE 9-22-

ANK IDENT: 125

OCATION: RECLAIM CRUDE

JUNE 10, 1986

ZLES AND CONDITION:

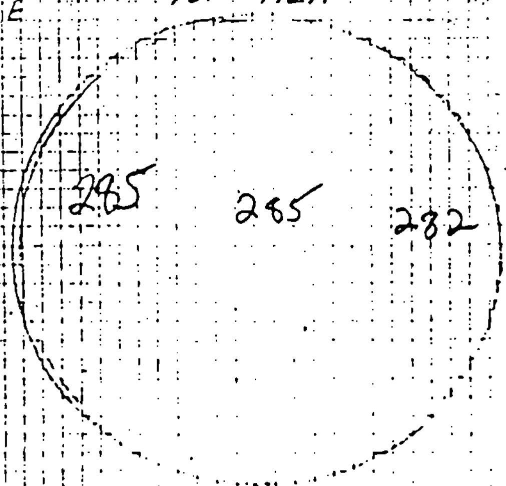
O.K

O.K

O.K

O.K

TOP VIEW



AFETY CONTROLS AND CONDITIONS:

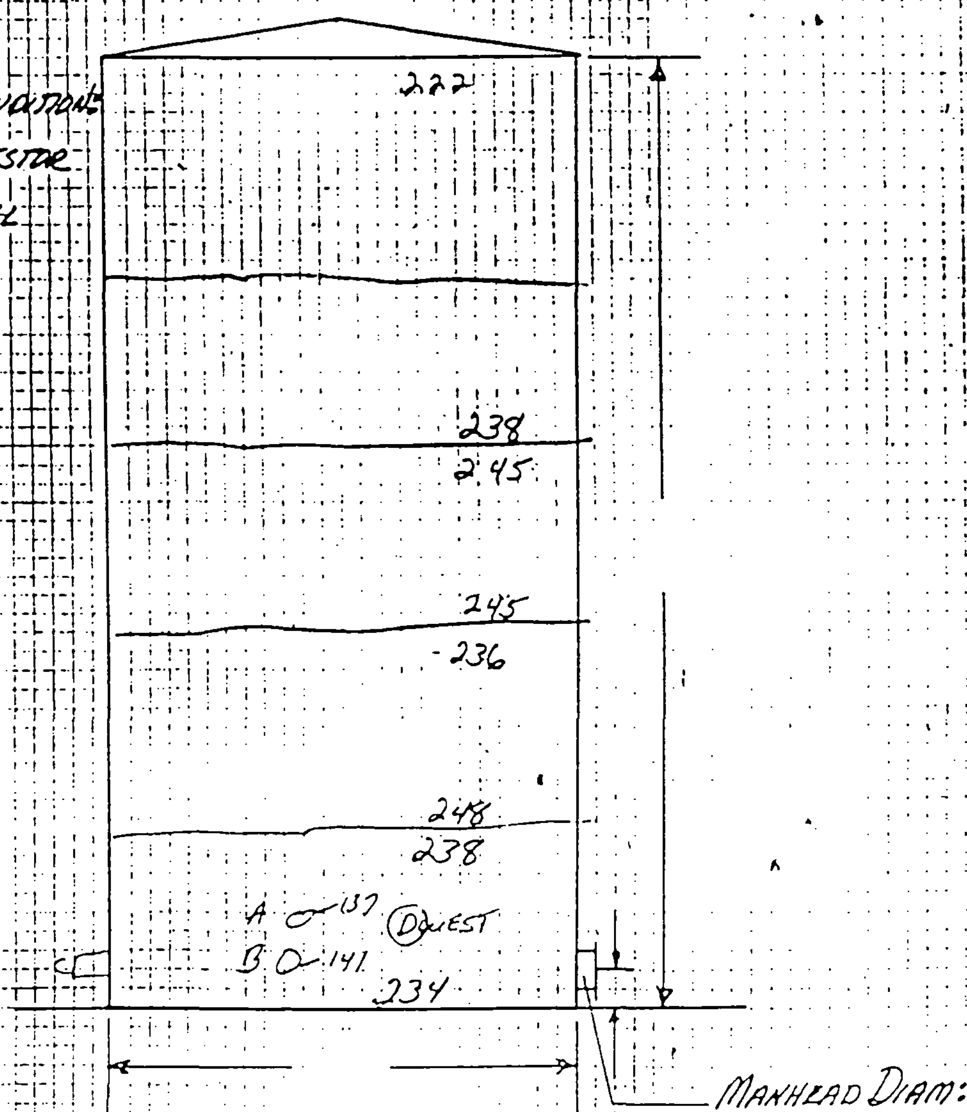
BREATHER AND 2" ARRESTOR

GAUGE AND LIQUID SEAL

LEVEL ALARM

DESIGN STANDARDS:

ANK EXTERIOR:



TANK 125

TOP VIEW

N

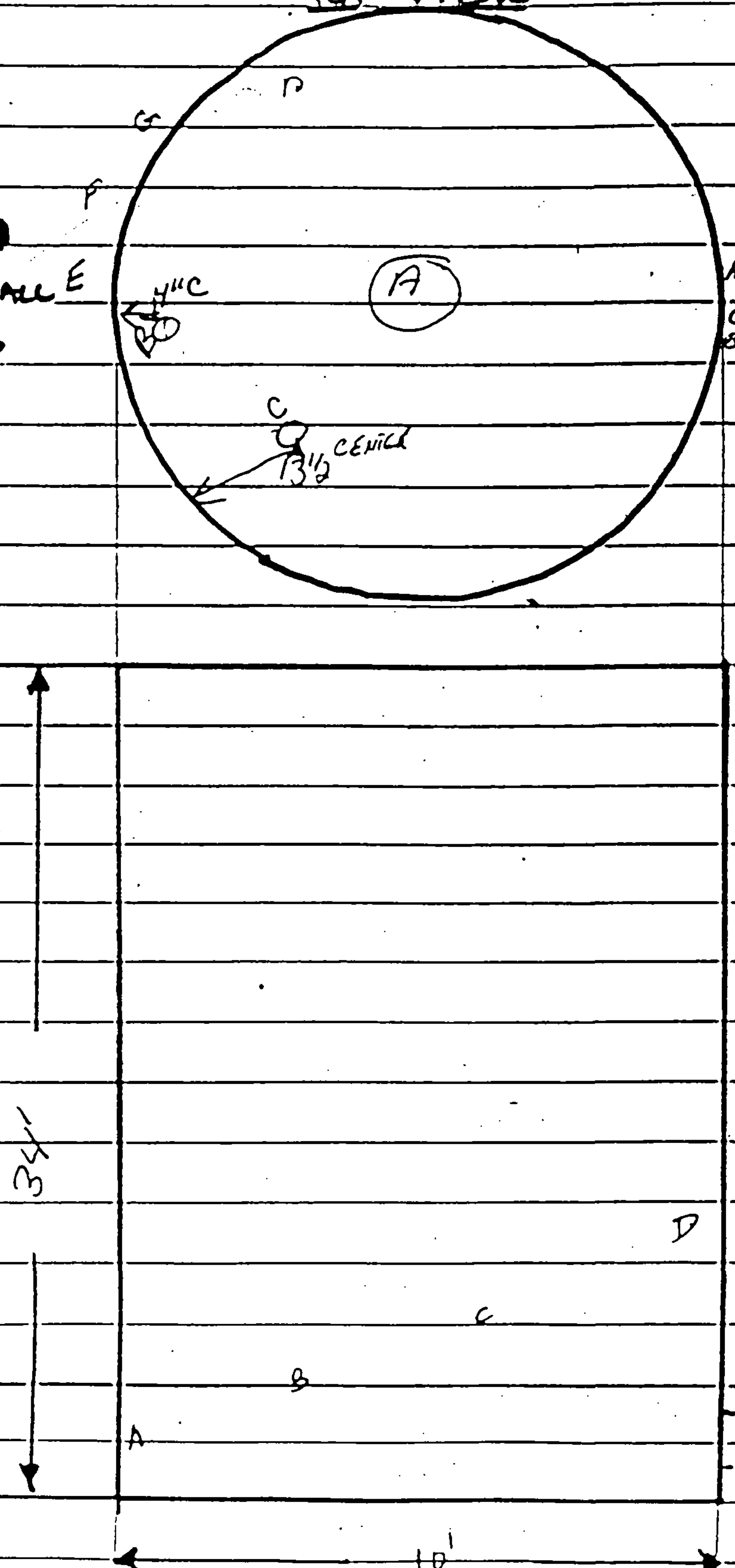
TES— [redacted]

...ATE SIDEWALL
...TINGS IN TOP
...EW

...CATE GAGE
TOP VIEW

...CATE RISER
...PE IF
...TACHED

...TE CATWALK



TOP FITTINGS

SIZE	USE
A. 21"	MANHEA
B. 3"	CAP
C. 2"	cap
D.	

27 JUNE 85

THICKNESS READ...

A. .242
B. .261
C. .263
D. .240

SIDE WALL FITTI...

SIZE	ABOVE
A. 3" FROM TOP	134
B. 2"	24"
C. 2"	8"
D. 2"	19½
E. 3"	12"
F 21" MAN HEAD	28"
G AGITATOR	27"
H 2"	6"

MANHEAD DIAM ___

TANK IDENT: 126

OCATION: B

MAR 8, 1987

JUNE 10, 1986

ZLES AND CONITION & READING

MAN WAY .212

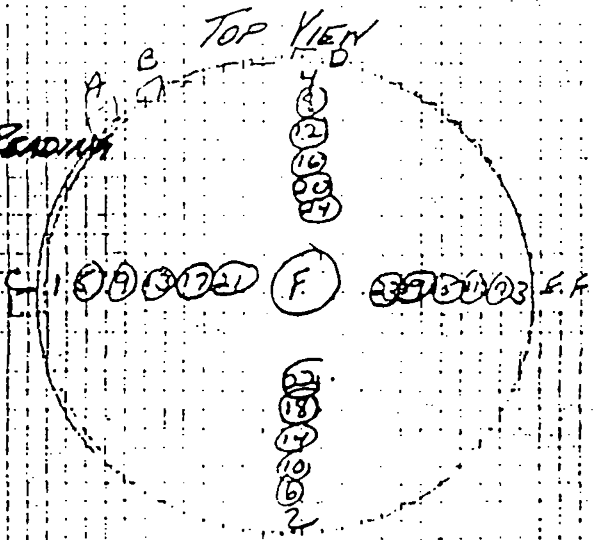
ADDITATOR BLIND .211

3" NIPPLE .212

2" NIPPLE .136

2" NIPPLE .152

MAN WAY



CHECKED 8-13-87

FETY CONTROLS AND CONDITION:

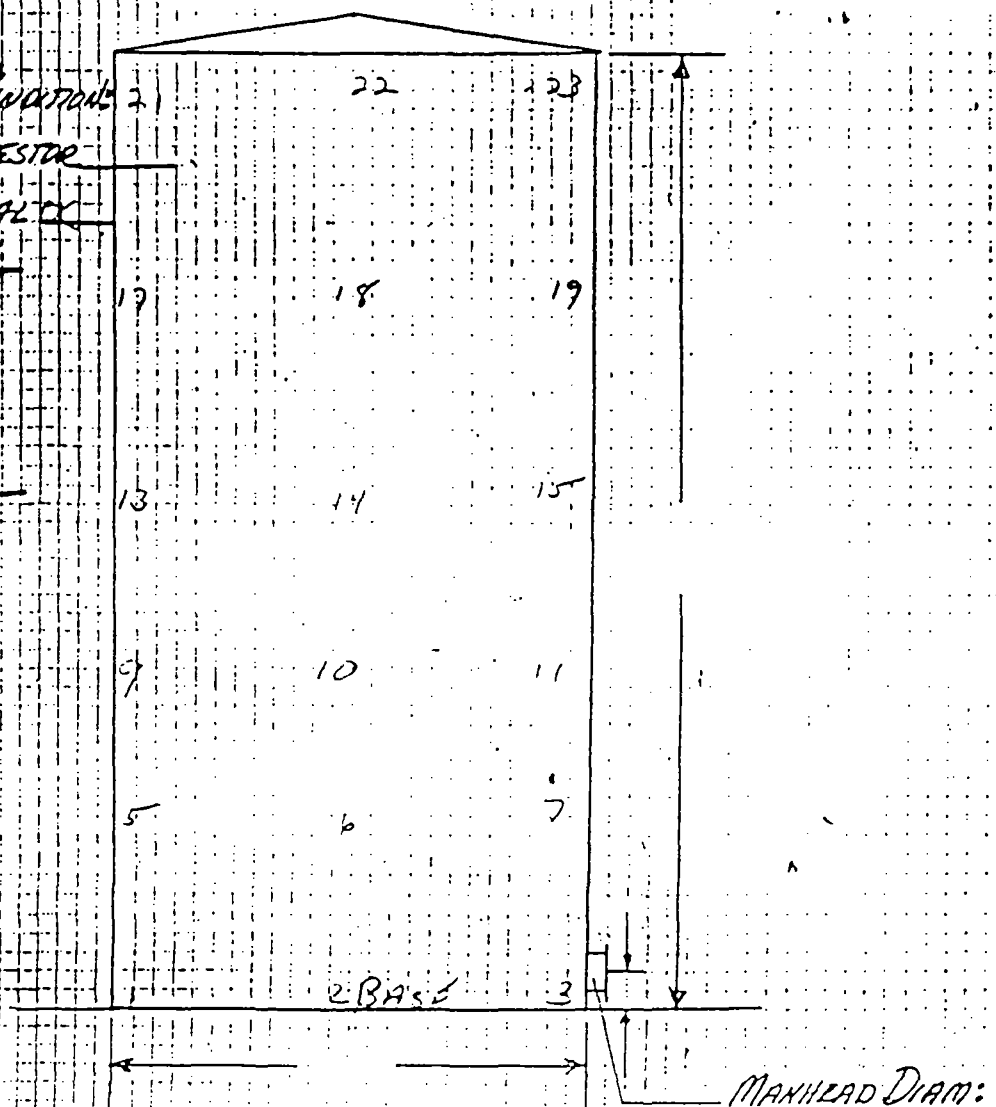
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

ESIGN STANDARDS:

NK EXTERIOR: OK



TANK: 126

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

STR SIDE .143

HEIGHT ABOVE STR. SIDE	READING
BASE	.244
"	.248
"	.246
"	.247
SIX FEET UP	.237
"	.230
"	.234
"	241
TWELVE FEET UP	.247
"	.249
"	.246
"	.249
18" UP	.232
	.228
	234
	.244
24' UP	252
	.258
	.250
	.252
TOP SIDE OF TANK	.258
	.252
	.245
	250
TOP OF TANK	.256
	.262
	.260
	.258

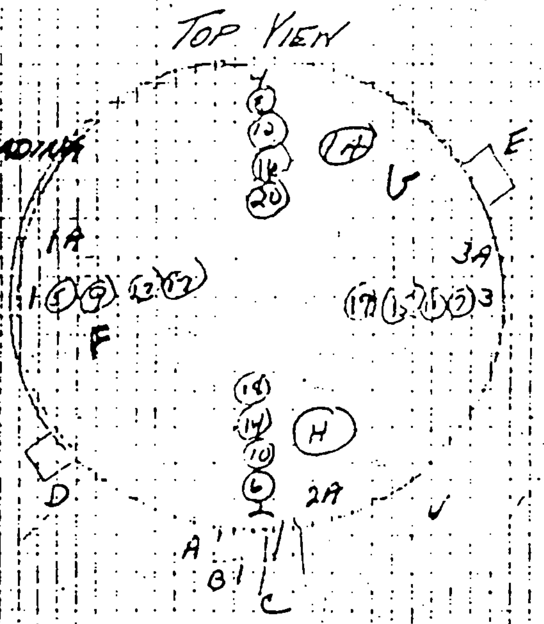
~~~~ PROFILE DATE: MAY 8, 1987

TANK IDENT: 202

LOCATION: C

JUNE 10, 1986

TOP VIEW



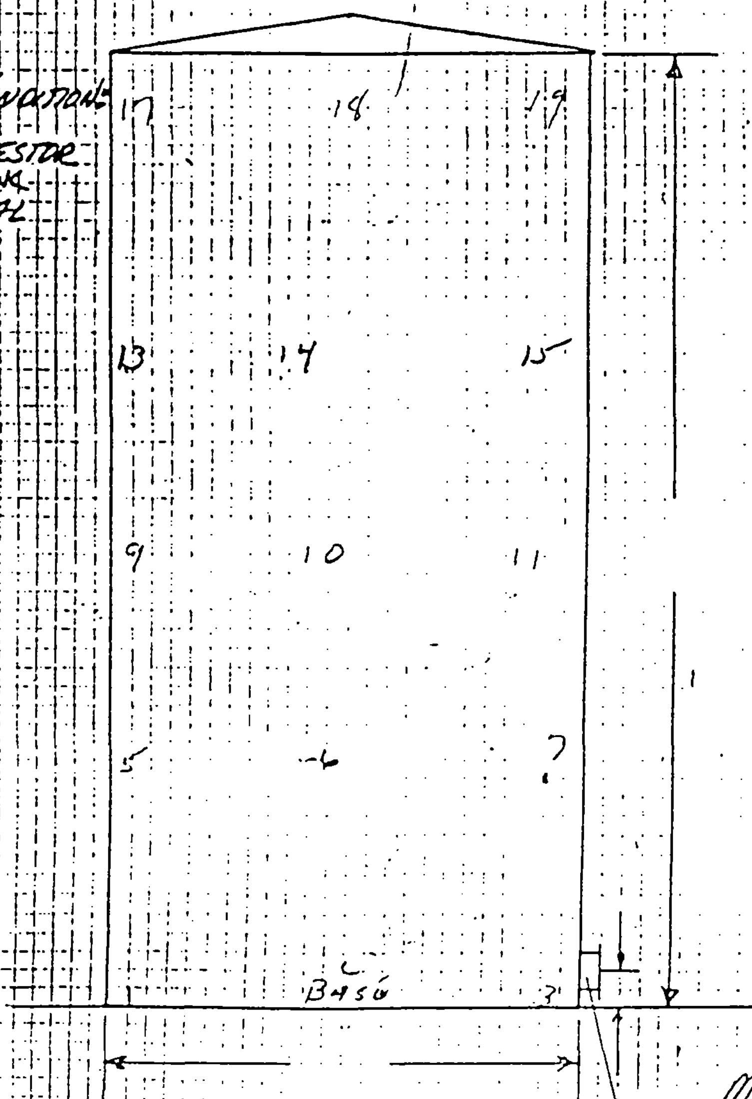
NOZZLES AND CONDITION: READING
MANWAY .278
2" NIPPLE .129
2" NIPPLE .138
4" CAP OK
3" NIPPLE .243
4" NIPPLE .210
2" RISER OK
MANWAY OK

CHECK 9-10-87

SAFETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR
OK OK
GAUGE AND LIQUID SEAL
OK FILLED SEAL
LEVEL ALARM O.K

DESIGN STANDARDS:

TANK EXTERIOR: OK



MANHEAD DIAM:
~~~~

TANK: 202

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

BASE .130

ABOVE 6' .102

HEIGHT ABOVE STR. SIDE	READING
BASE	.237
"	.238
"	.252
"	.246
SEVEN FEET UP	.169
"	.168
"	.174
"	.170
FOURTEEN FEET UP	.164
"	.188
"	.188
"	.188
21 FEET UP	.175
	.176
	.177
	.181
TOP SIDE OF TANK	.172
	.172
	.173
	.171
TOP OF TANK	.208
	.204
	.200
	.209

TANK PROFILE

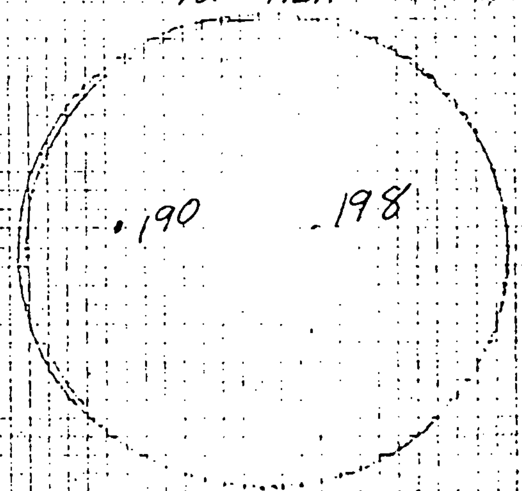
DATE: NOV. 10, 198
JUNE 10, 1986

TANK IDENT: 202

LOCATION:

NOZZLES AND CONDITION:
2" .136 OK
2" .140 OK
RISER OK

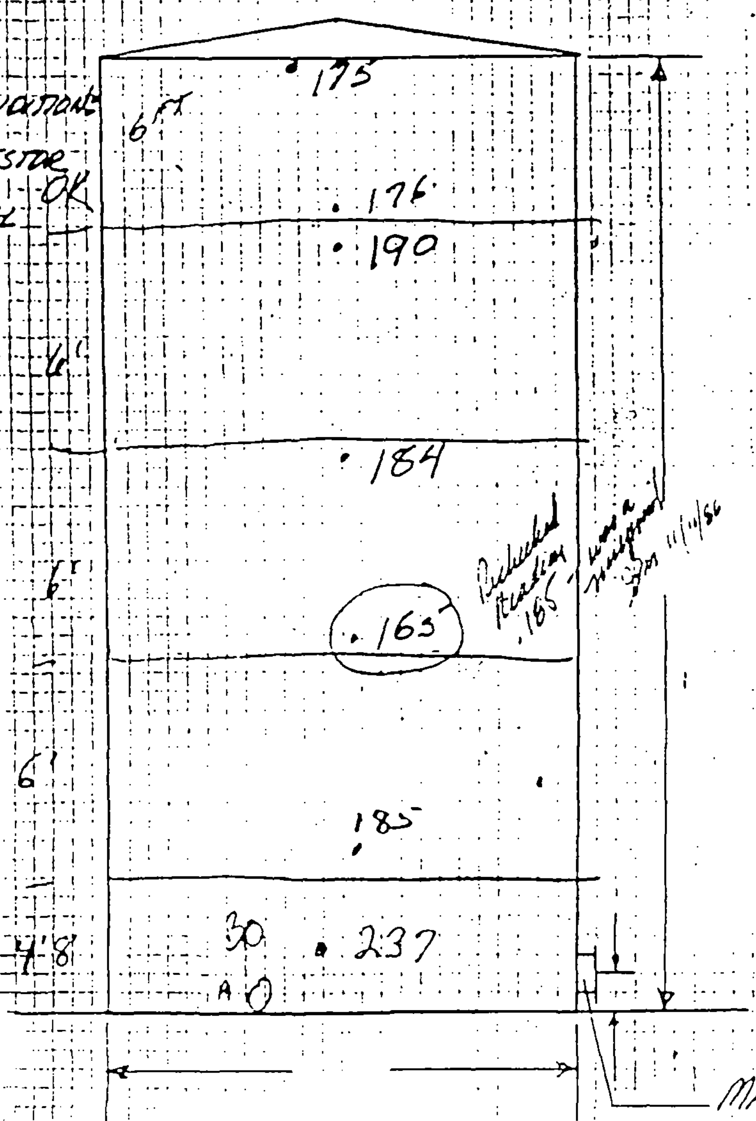
TOP VIEW



SAFETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL OK
LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK



MAY 8, 1987

ANK IDENT: 203

CATION: C

JUNE 10, 1986

ZLES AND CONITION & READING

MAN WAY 205

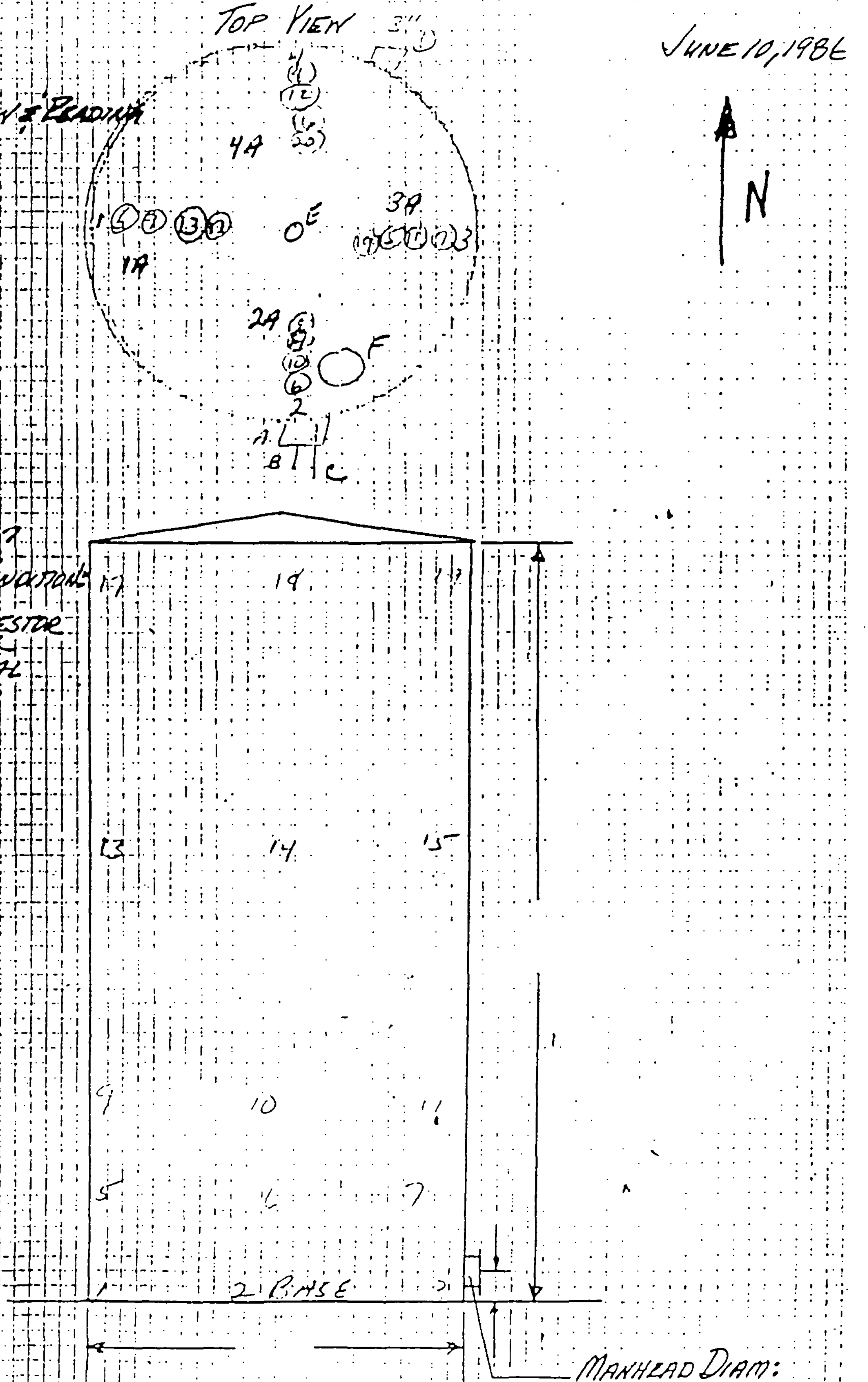
3" NIPPLE .189

2" NIPPLE 148

3" CAP OK

3" NIPPLE OK

MAN WAY OK



CHECKED 8-10-87

ETY CONTROLS AND CONDITION

BREATHER AND 2" ARRESTOR
OK OK

GAUGE AND LIQUID SEAL
OK FILLED SEAL

LEVEL ALARM OK

ESIGN STANDARDS:

NK EXTERIOR: OK

TANK: 203

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

BASE .120

ABOVE 6' .093

NT	HEIGHT ABOVE STR. SIDE	READING
	BASE	.213
	"	.217
	"	.214
	"	.216
	SEVEN FEET UP	.155
	"	.144
	"	.144
	"	.148
	FOURTEEN FEET UP	.146
	"	.153
	"	.145
	"	.148
	21 FT UP	.134
		.137
		.145
		.134
	TOP SIDE	.145
	TOP SIDE	.164
		.168
		.167
	TOP OF TANK	
		.128
		.156
		.167
		.110

11 TANK PROFILE

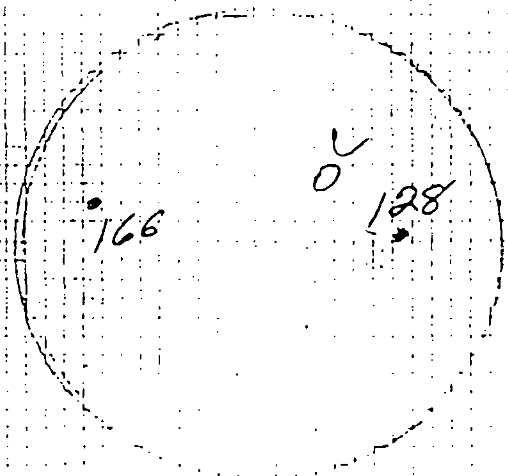
DATE:
NOV 10 1986

TANK IDENT: 207

LOCATION:

JUNE 10, 1986

TOP VIEW

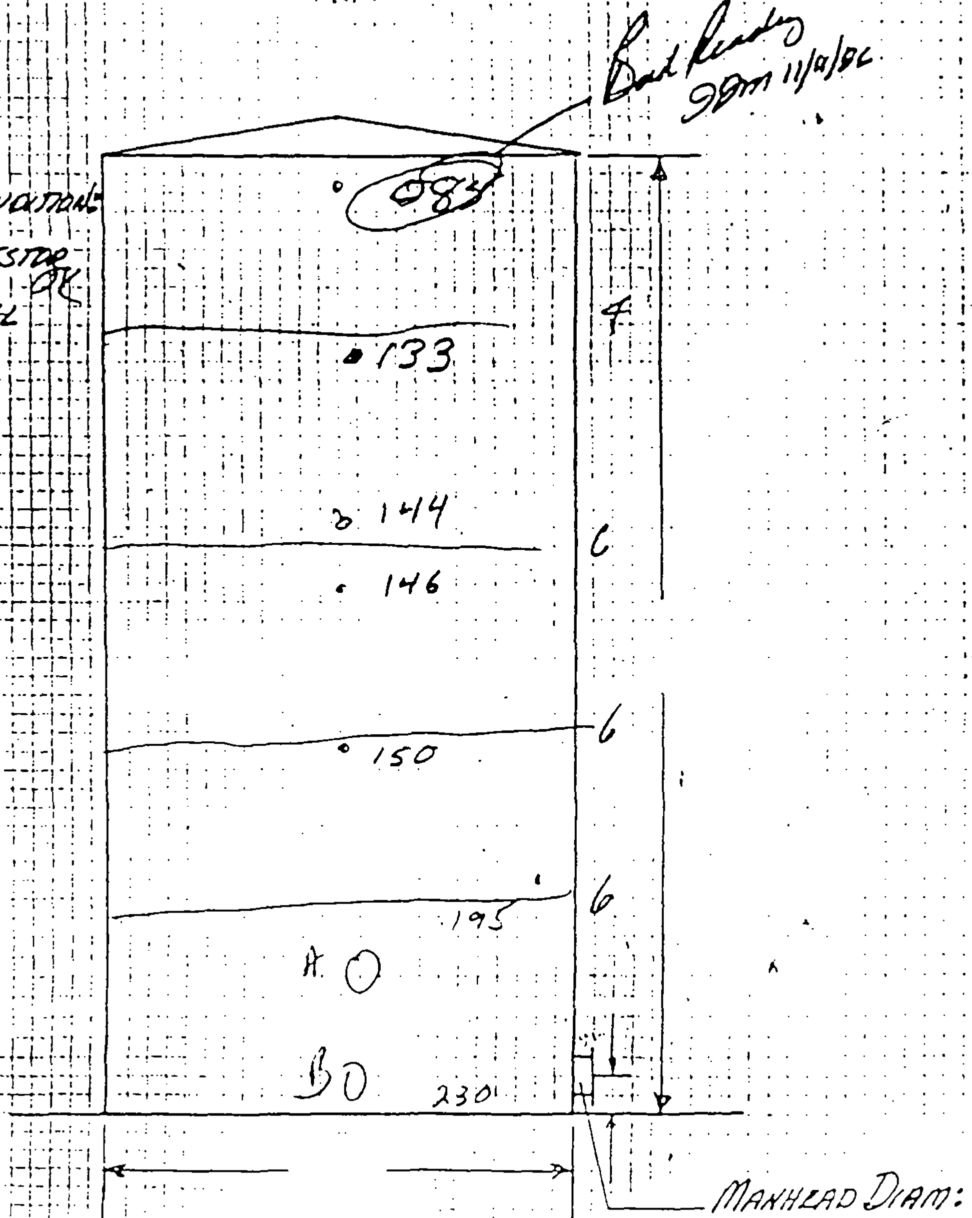


NOZZLES AND CONDITION:
8" - 189 OK
2" 145 OK
GISEL OK

SAFETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL OK
LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR:



MAY 8, 1987

JUNE 10, 1986

ANK IDENT: 204

CATION: C

ZLES AND CONDITION & READING

MAN WAY .460

1" NIPPLE .109

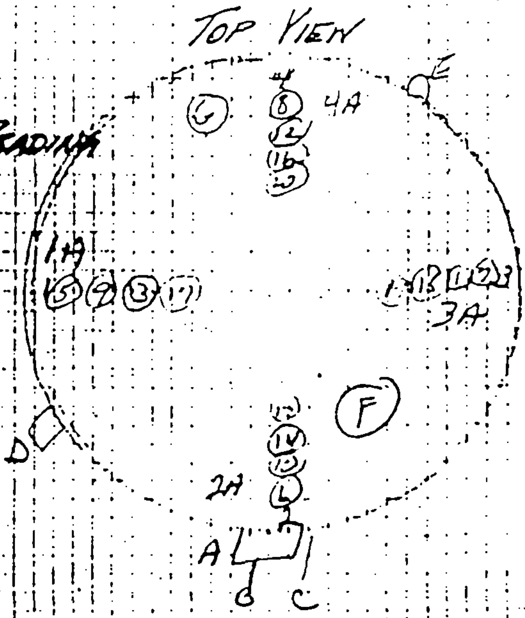
2" NIPPLE .146

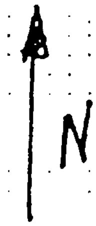
3" CAP

3" CAP

MANWAY OK

2" RISER OK





FETY CONTROLS AND CONDITIONS

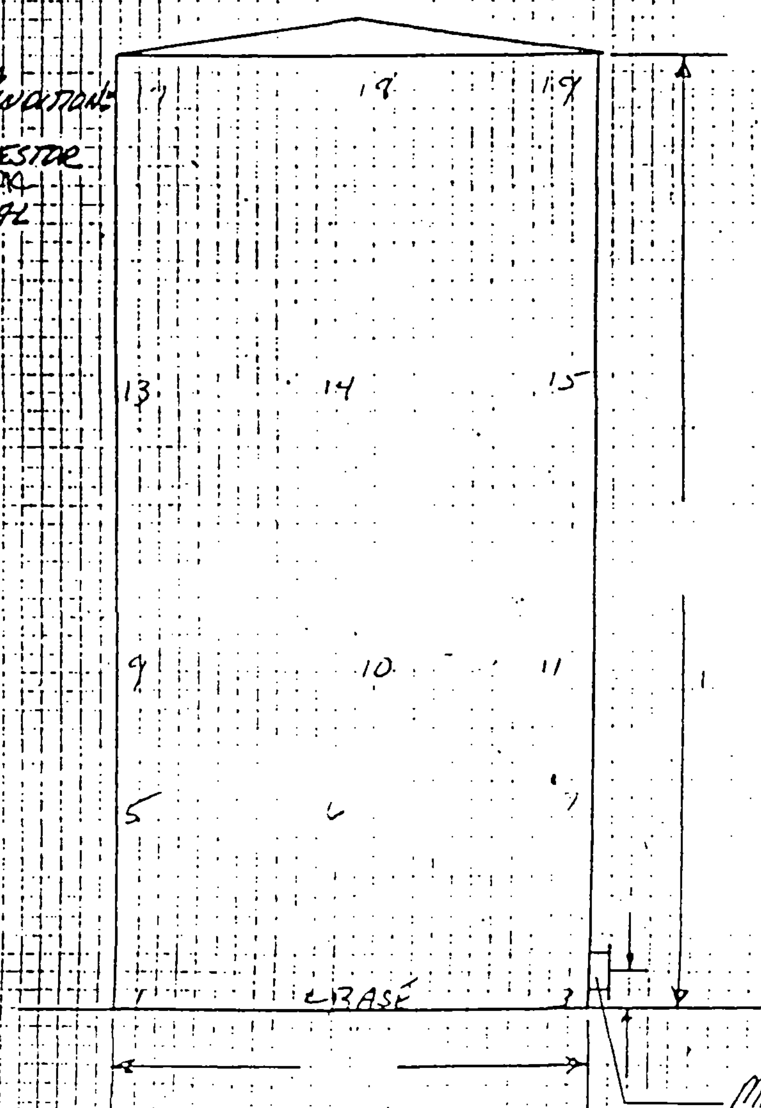
BREATHER AND 2" ARRESTOR
OK OK

GAUGE AND LIQUID SEAL
OK FILLED SEAL

LEVEL ALARM OK

SIGN STANDARDS:

K EXTERIOR: OK



MANHEAD DIAM:

TANK: 204

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 8, 1987

MINIMUM WALL:

BASE .120

ABOVE 6' .093

NT	HEIGHT ABOVE STR. SIDE	READING
	BASE	
	"	.225
	"	.221
	"	.226
		.231
	SEVEN FEE T UP	
	"	.152
	"	.150
	"	.155
		.146
	FOURTEEN FEET UP	.144
	"	.146
	"	.140
	"	.148
	21 FT UP	.130
		.146
		.142
		.134
	TOP SIDE	.174
		.170
		.171
		.171
		.177
		.174
		.173
		.170

TANK PROFILE

DATE: NOV 10 1986

ANK IDENT: 204

JUNE 10, 1986

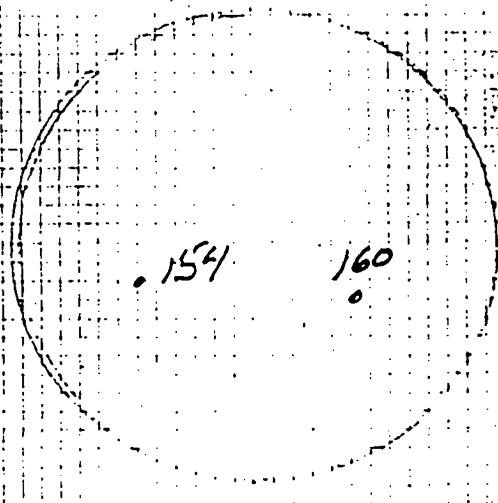
CATION:

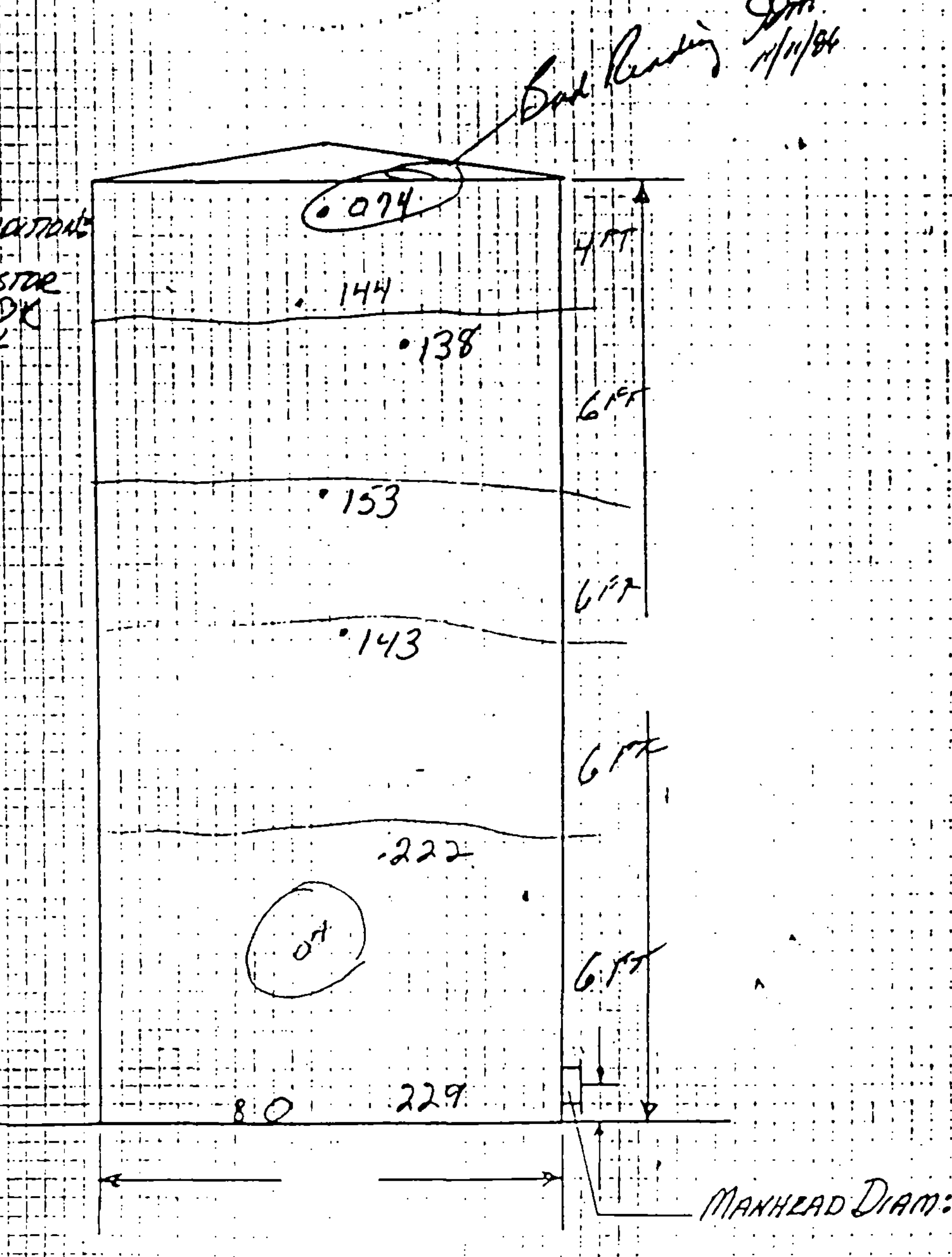
ZLES AND CONITION:

1" .117 OK

2" .145 OK

TOP VIEW





FETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK

LEVEL ALARM OK

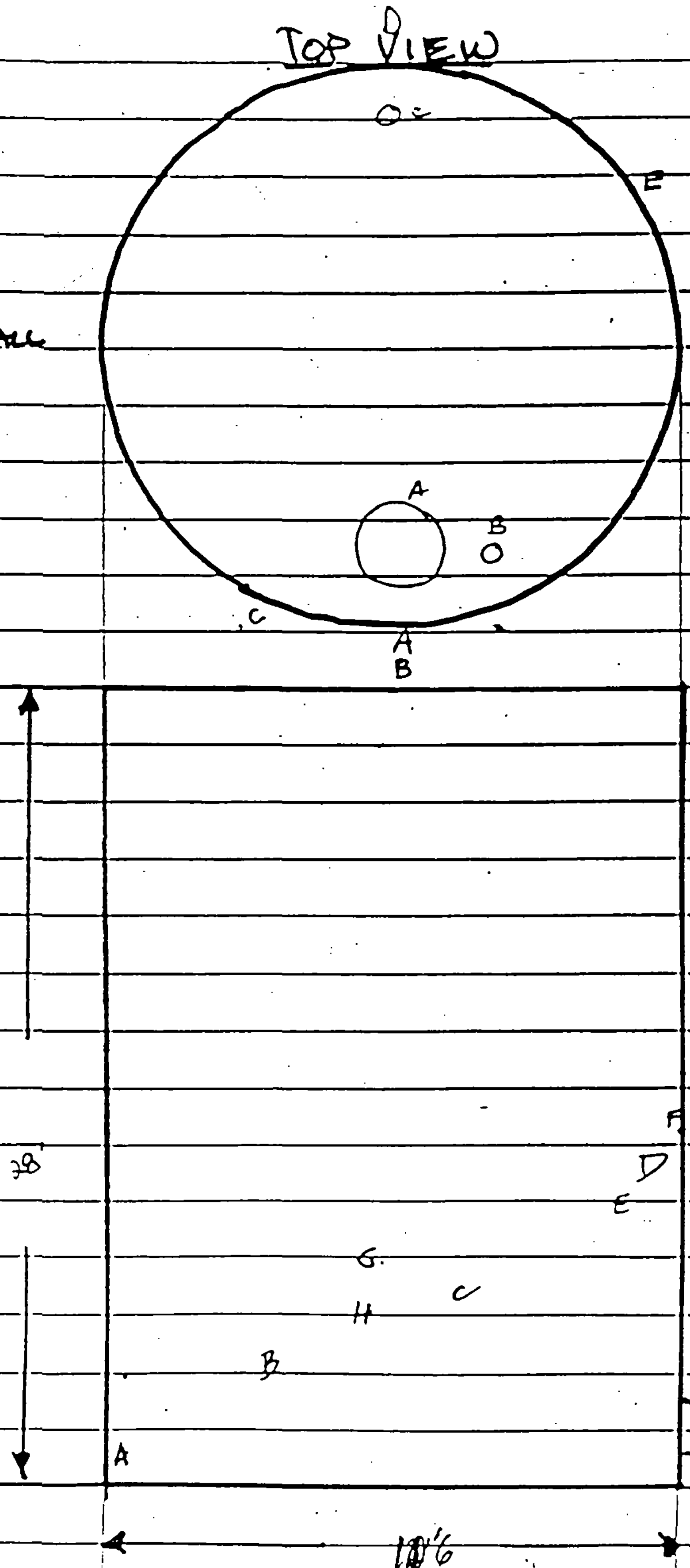
ESIGN STANDARDS:

NK EXTERIOR: OK

TANK 204

ES—
ATE SIDEWALL
TWGS [redacted]OP
W

CATE GAGE
TOP VIEW
CATE RISER
DE IF
TACHED



TOP FITTINGS
SIZE USE
A. MANHEAD W/GA
B. 2" OLD GA
C.? 2" W/RISER
D. ? 4" W/OLD FLAM ARRE
27 JUNE 85

THICKNESS READIN
A. .205
B. .225
C. .209
D. .142
E. .144
F. .149
G. .141
H. .222

SIDE WALL FITTI
SIZE ABOVE G
A. MANHEAD W/2" ...
B. 2" ON GROUND
C. 3" ~~2'~~ 5
D. UNDERGROUND FIT
E. 3" 5

MANHEAD
DIAM 29"

TANK PROFILE

MAY 15, 1987

JUNE 10, 1986

N

TANK IDENT: 205

LOCATION: C

LES AND CONITION & READING

MAN WAY 318

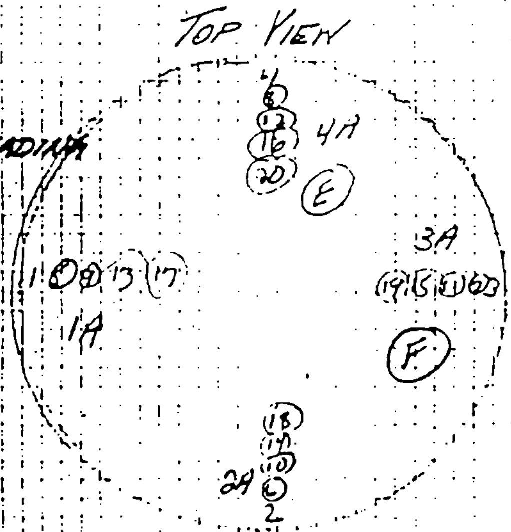
2" NIPPLE 216

4" CAP OK

2" NIPPLE 196

RISER 148

MANWAY



CHECK 8-10-87

SAFETY CONTROLS AND CONDITION:

OK OK

BREATHER AND 2" ARRESTOR

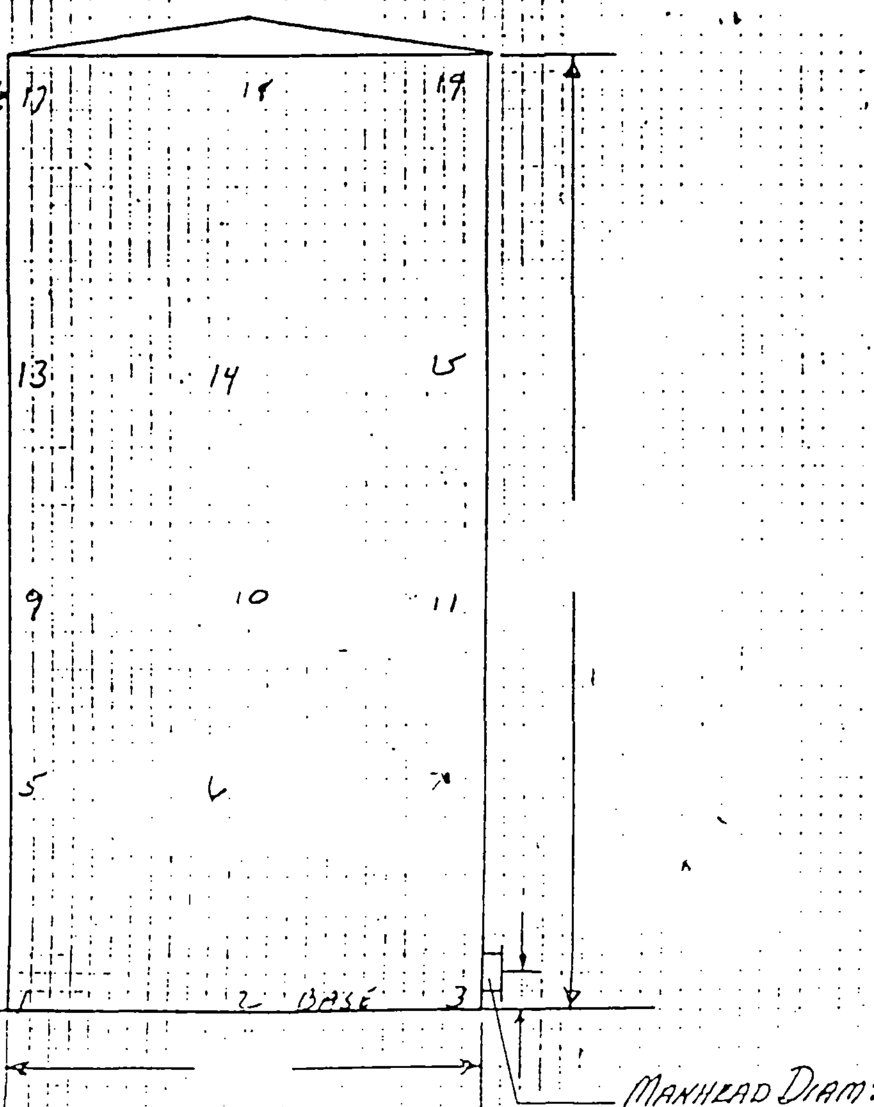
GAUGE AND LIQUID SEAL OK

OK FILLED

LEVEL ALARM O.K.

DESIGN STANDARDS:

TANK EXTERIOR: OK



TANK: 205

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 15, 1987

MINIMUM WALL:

BASE .130

ABOVE 6' .120

HEIGHT ABOVE STR. SIDE	READING
BASE	.243
"	.238
"	.241
"	.238
SEVEN FEET UP	.177
"	.187
"	.183
"	.177
FOURTEEN FEET UP	.203
"	.196
"	.194
"	.202
21 FT UP	.166
	.170
	.165
	.160
Top Side	.167
	.163
	.173
	.161
Top	
	.202
	.188
	.206
	.196

TANK PROFILE

DATE -
NOV. 10, 199[illegible]

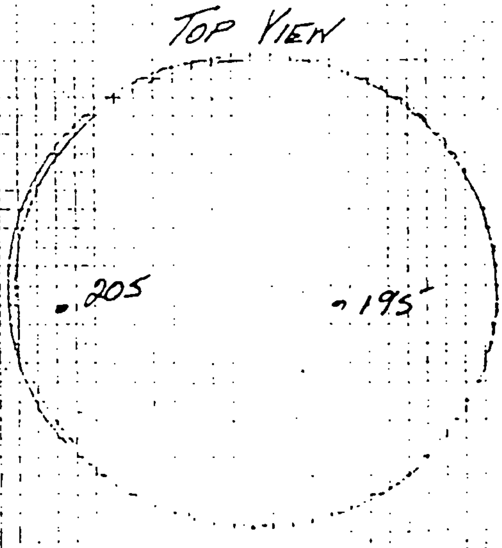
JUNE 10, 1986

TANK IDENT: 205

LOCATION:

NOZZLES AND CONDITION:
2" 214 OK
4" 204 OK
RISER OK

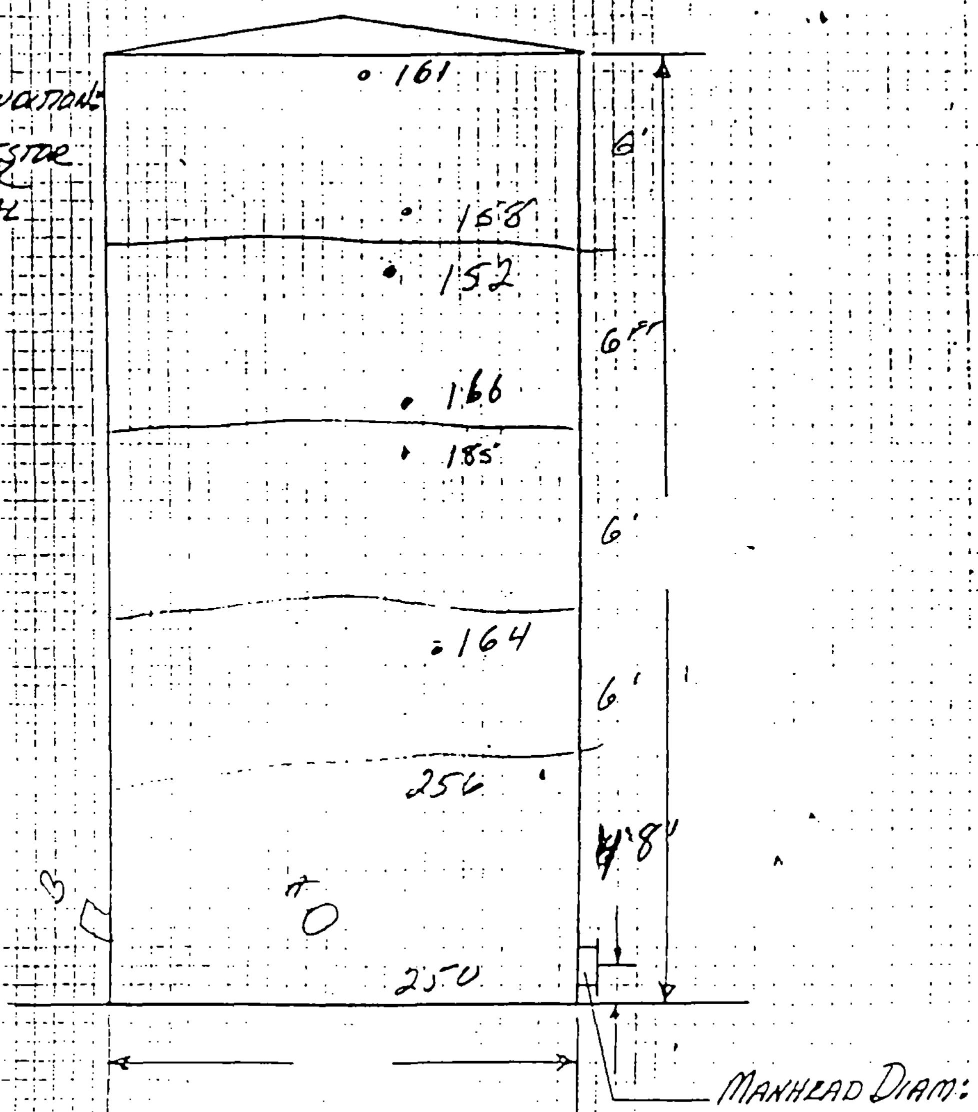
TOP VIEW



SAFETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR
OK OK
GAUGE AND LIQUID SEAL
OK
LEVEL ALARM OK

DESIGN STANDARDS:

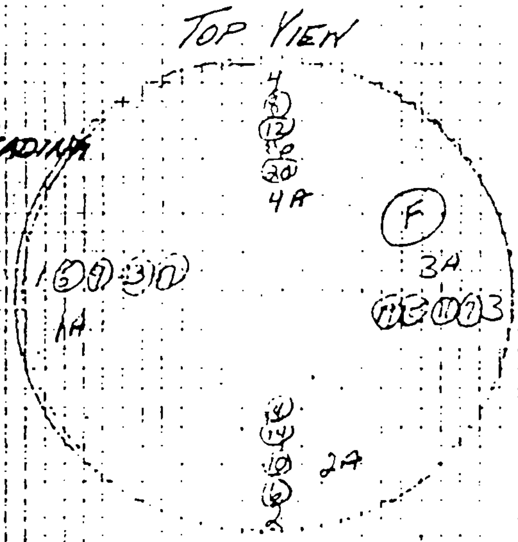
TANK EXTERIOR: OK

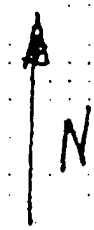


TK IDENT: 206

LOCATION: C

JUNE 10, 1986





NOZZLES AND CONDITION & READINGS

MAN WAY .239

3" NIPPLE .180

2" NIPPLE .130

4" COUPLING OK

RISER 21" .110

MAN WAY OK

SAFETY CONTROLS AND CONDITION

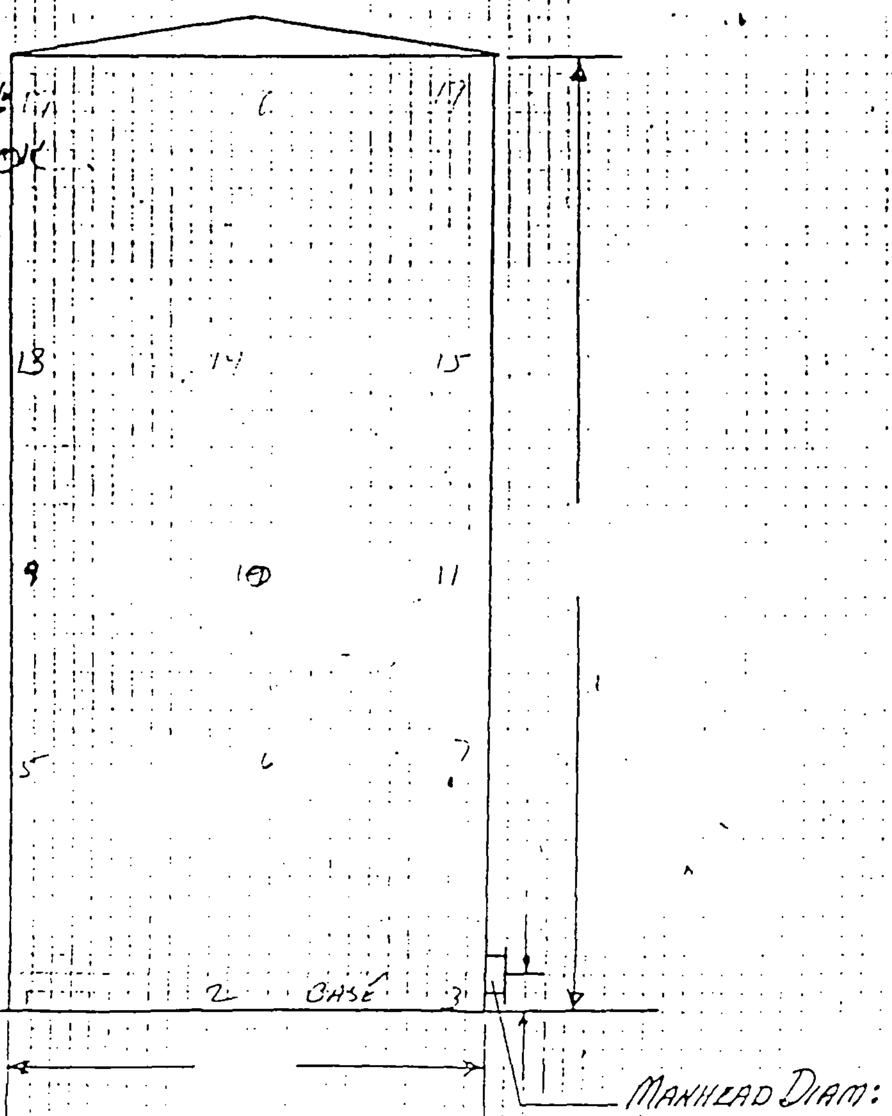
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK
OK
FILLED SEAL

LEVEL ALARM OK

DESIGN STANDARDS:

TK EXTERIOR: OK



TANK: 206

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 15, 1987

MINIMUM WALL:

BASE .145

ABOVE 6' .112

INT	HEIGHT ABOVE STR. SIDE	READING
	BASE	.236
	"	.234
	"	.231
	"	.241
	SEVEN FEET UP	.219
	"	.222
	"	.214
	"	.214
	FOURTEEN FEET UP	.218
	"	.219
	"	.218
	"	.212
	21 FT UP	.198
		.200
		.210
		.206
	TOP SIDE	.233
		.224
		.210
		.220
	TOP OF TANK	.157
		.194
		.193
		.166

TANK PROFILE

DATE - NOV 10, 1986

JUNE 10, 1986

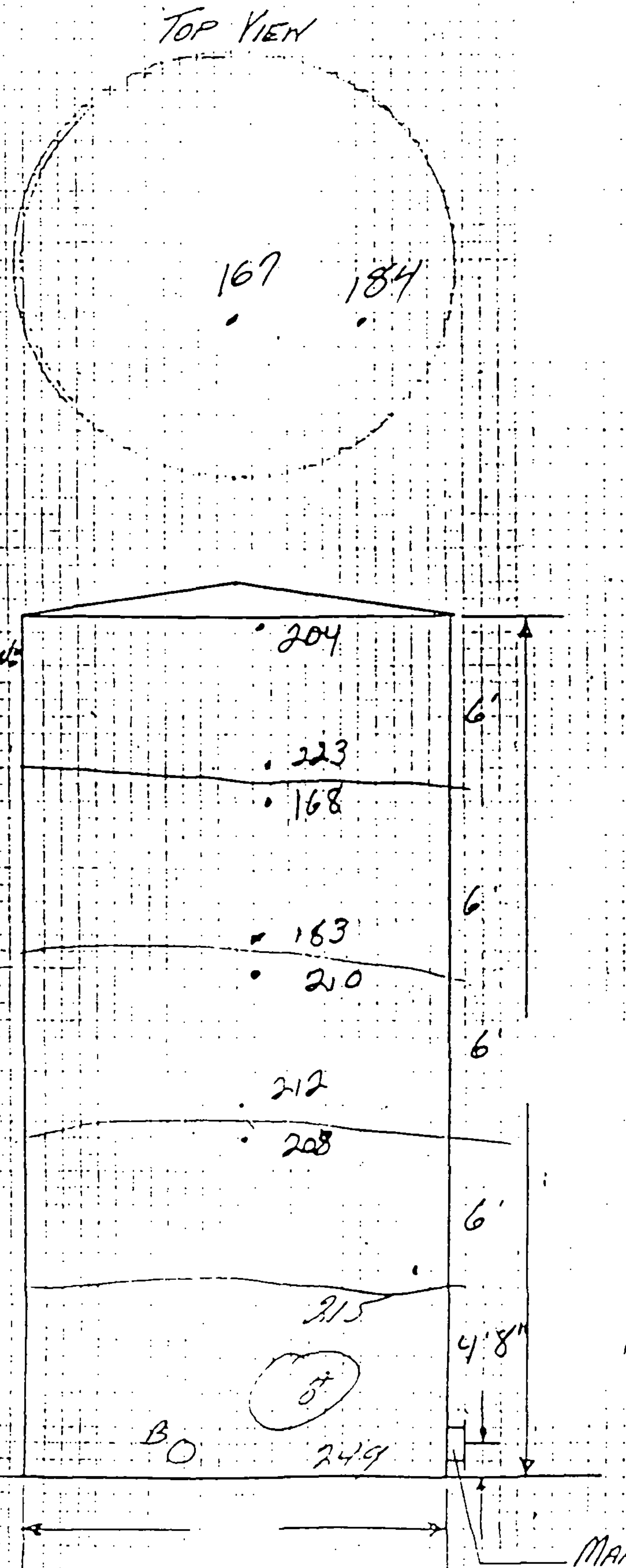
TANK IDENT: 206

LOCATION:

NOZZLES AND CONDITION:

3" .190

2" .125



SAFETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR OK OK

GAUGE AND LIQUID SEAL OK

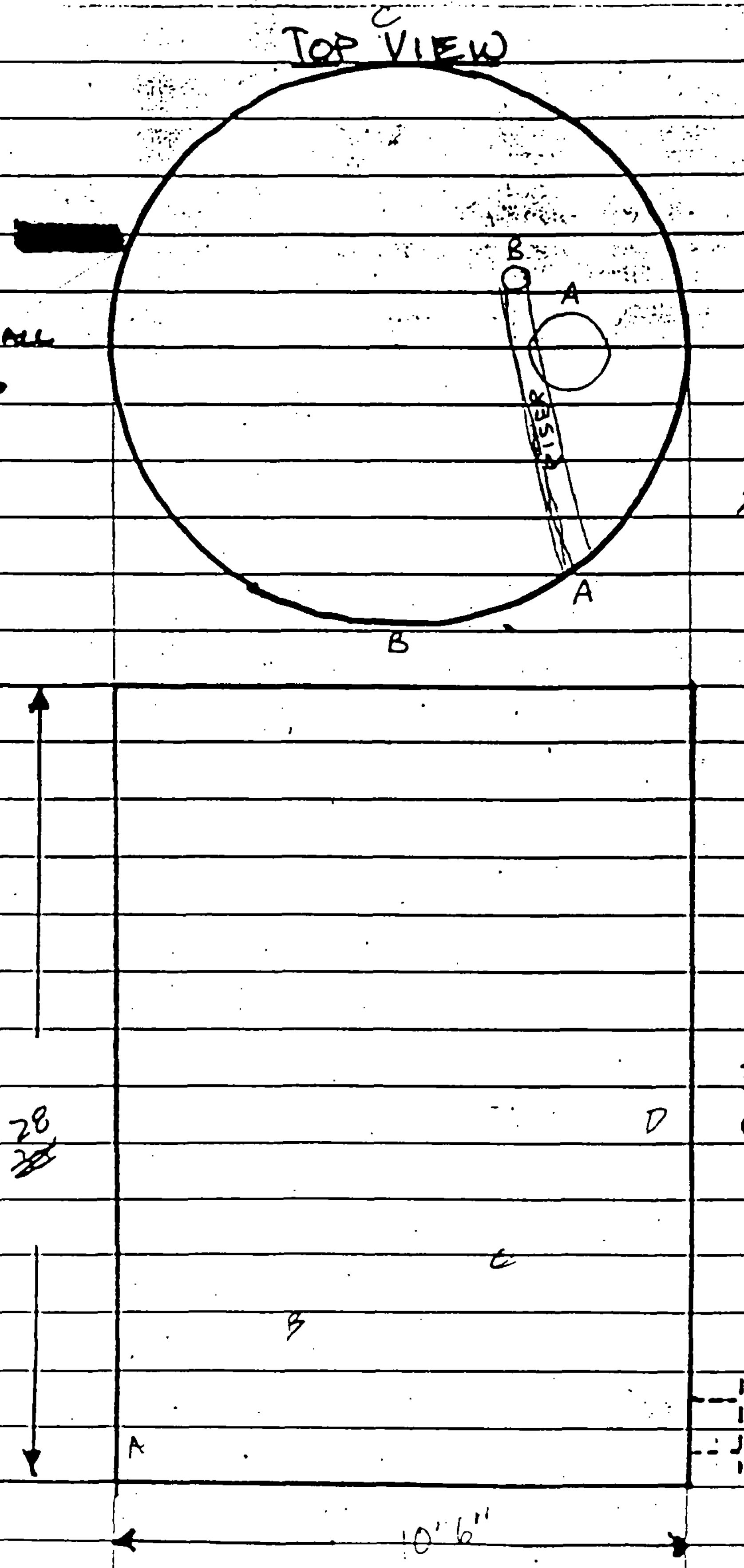
LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK

TANK 206

TOP VIEW



…RES —
…CATE SIDEWALL
…TINGS IN TOP
…EW

…OCATE GAGE
… TOP VIEW

…CATE RISER
PIPE IF
…TACHED

TOP FITTINGS

SIZE	USE
A. MANHEAD W/GA…	
B. 4" or 3" W/…	
C.	
D.	

27 JUNE 85

THICKNESS READING

A. .242
B. .226
C. .205
D. .224

SIDE WALL FITTI…

SIZE	ABOVE G…
A. MANHEAD	
B. 4" W/VALVE	
C. 4" PLUG	
D.	
E.	

MANHEAD DIAM —

TANK PROFILE

DATE: 10 JUNE 1987

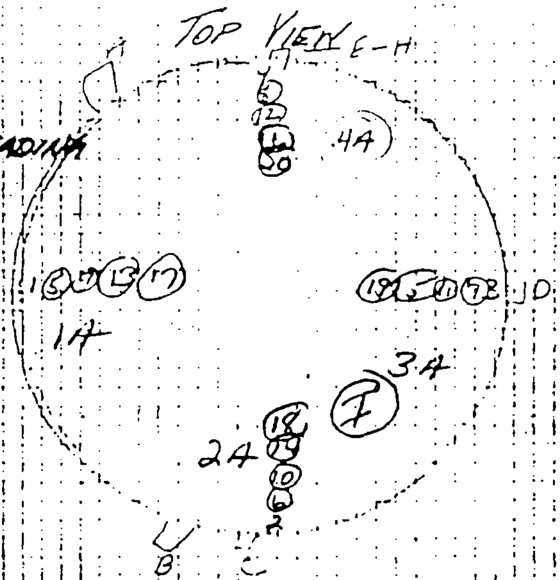
JUNE 10, 1986

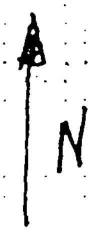
TNK IDENT: 210

CATION: C

ZLES AND CONDITION & READING

- MAN WAY 296
- 8" PIPE 310
- 1" COUPLING OK
- 2" COUPLING OK
- 3" NIPPLE 202
- 3" NIPPLE 217
- 3" NIPPLE OK
- 3" NIPPLE OK
- MAN WAY





8-12-87

FETY CONTROLS AND CONDITION:

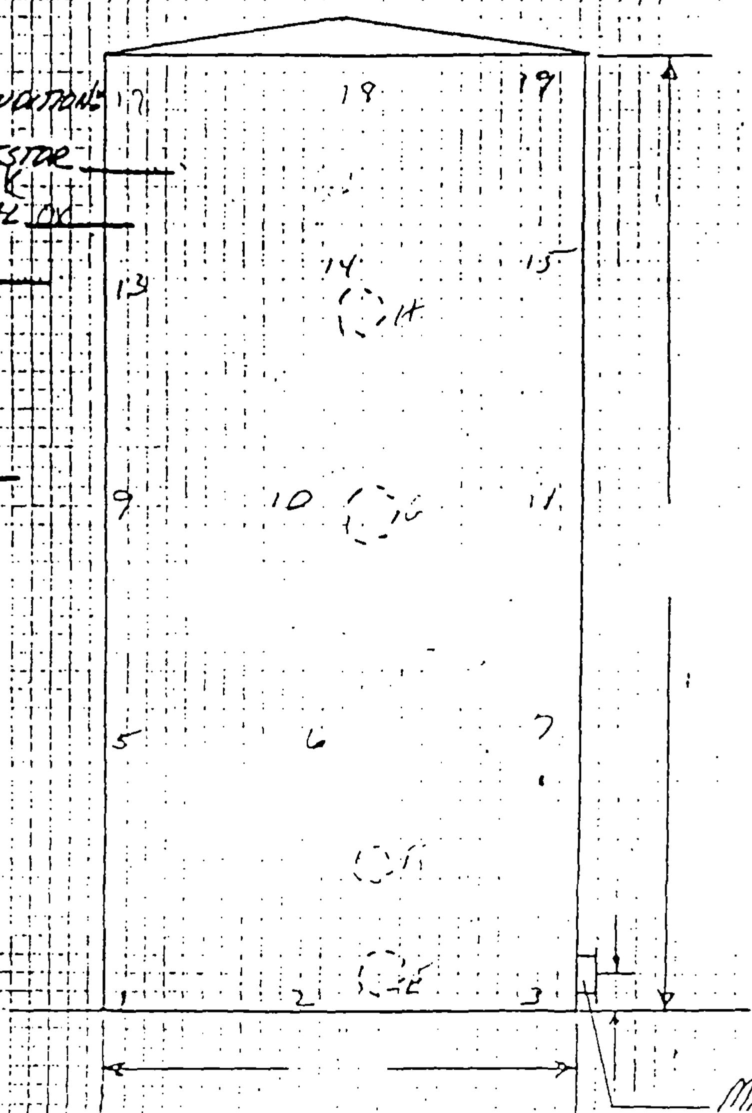
BREATHER AND 2" ARRESTOR OK OK

GAUGE AND LIQUID SEAL OK OK FILLED

LEVEL ALARM OK

ESIGN STANDARDS:

NK EXTERIOR: OK



MANHEAD DIAM:

TANK: 210

INSPECTOR: JOHN SPUDVILLE

DATE: 6-10-87

MAXIMUM WALL:

BASE .140

ABOVE 6' .108

INT	HEIGHT ABOVE STR. SIDE	READING
	BASE	.233
	"	.237
	"	.238
	"	.233
	SEVEN FEET UP	.237
	"	.162
	"	.169
	"	.155
	FOURTEEN FEET UP	.163
	"	.163
	"	.169
	"	.158
	21 FT. UP	.180 - .179
	"	.162
		.176
		.178
	TOP OF SIDE	.177
		.175
		.174
		.168
	TOP OF TANK	
7		.173
7		.160
7		.170
7		.167

TANK PROFILE

DATE: 10-1-8

..VK IDENT: 210

ATION: ENJECTI...

JUNE 10, 1986

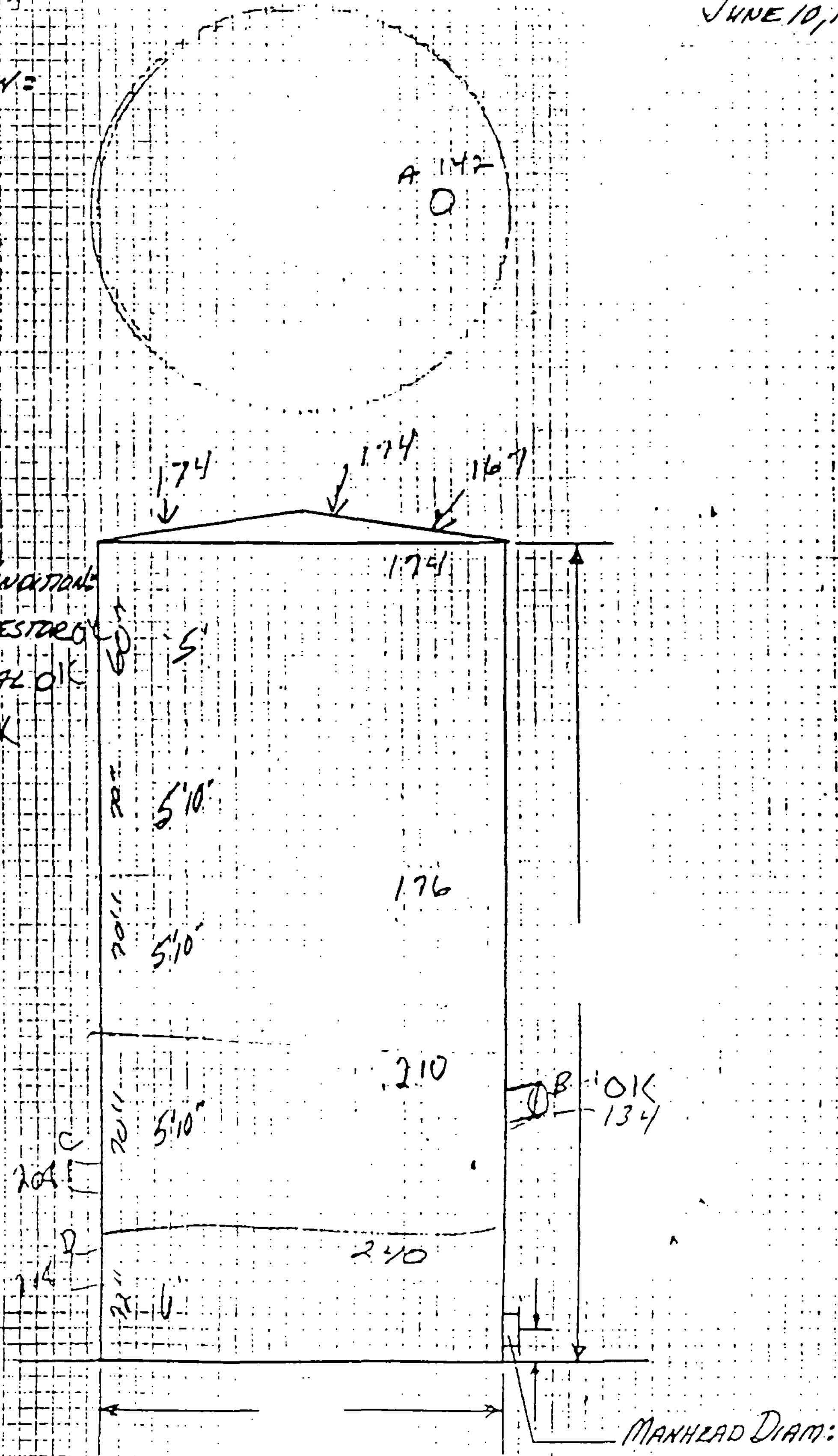
..ZLES AND CONITION:

142 OK

134

208

204



..ETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR OK

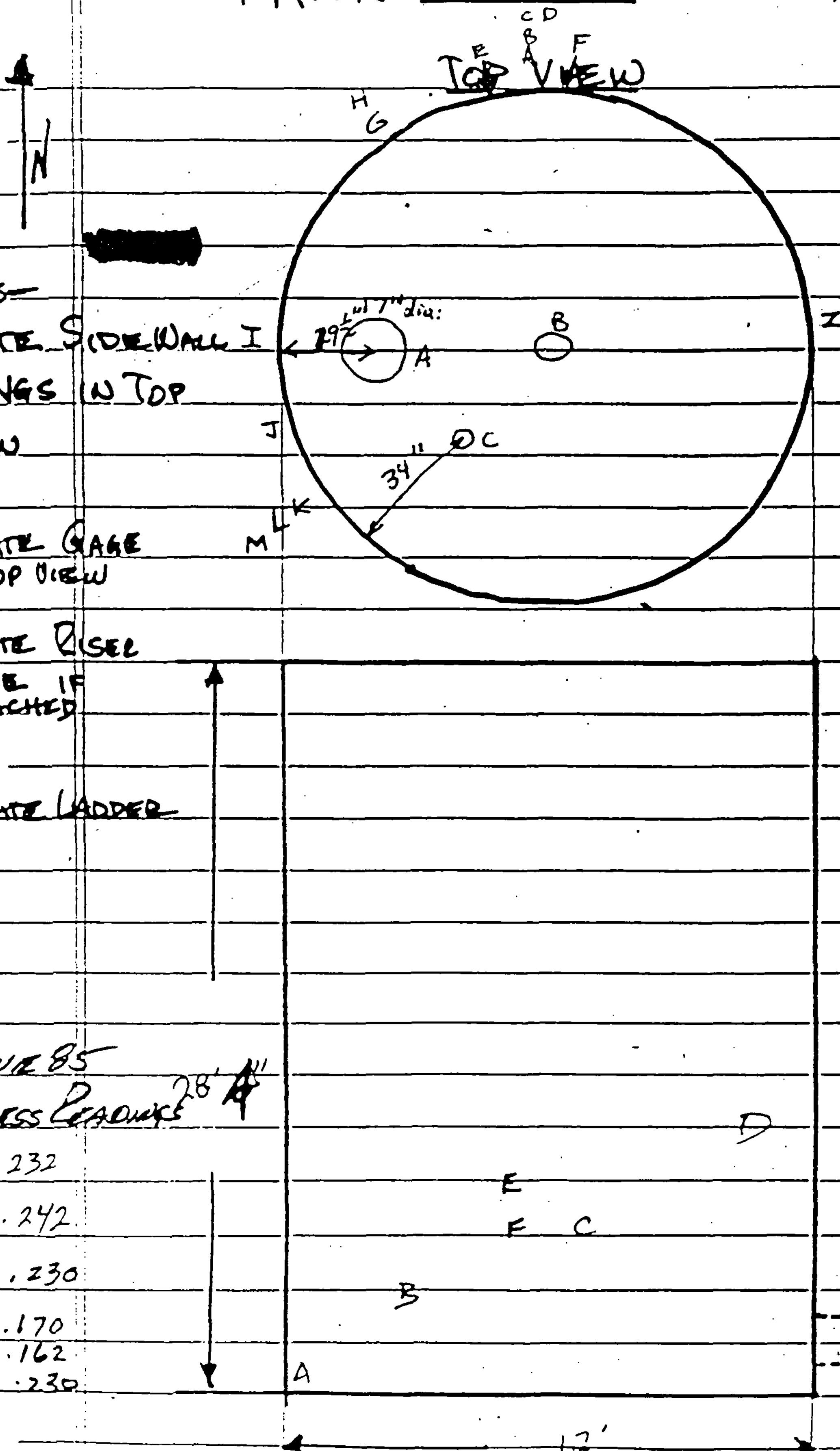
GAUGE AND LIQUID SEAL OK

LEVEL ALARM OK

..SSIGN STANDARDS:

..VK EXTERIOR: OK

TANK 210 *AGITATED*



[redacted]

TES

ATE SIDEWALL I

TINGS IN TOP

EW

ICATE GAGE
TOP VIEW

CATE RISER
PIDE IF
TTACHED

CATE LADDER

LINE 85
NESS READINGS

.232
.242
.230
.170
.162
.230

TOP FITTINGS

SIZE	USE
A. MANHEAD W/GA	
B. 2" VENT (THRE	
C. 3" W/RISER	
D.	

SIDE WALL CONT

I.	LADDER	
J.	AGITATOR	2
K.	3"	6'
L.	3" CAP	12'
M.	3" CAP	18
N	2" w/1" VALVE	

SIDE WALL FITTI

	SIZE	ABOVE
A.	3"	5'
B.	3"	35
C.	3"	12
D.	3" CAP	18
E.	2" PLUG	11"
F	2" PLUG	3'
G	2" PLUG	3

MANHEAD DIAM ___ 27"

MAY 15, 1997

JUNE 10, 1986

TANK IDENT: 211

LOCATION: C

NOZZLES AND CONDITION & READING

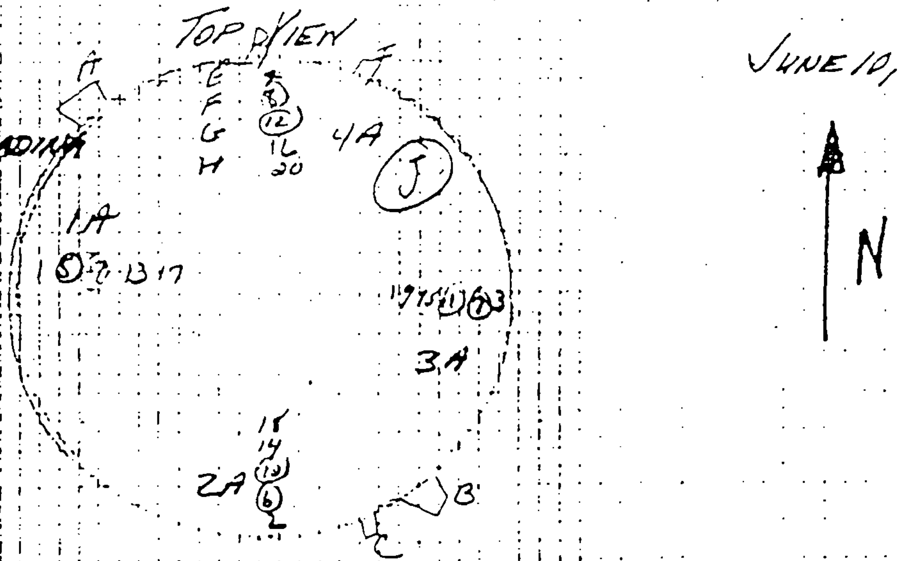
1 MANWAY 292
2 3" PIPE 316
2" NIPPLE 152
2" COUPLING OK
3" NIPPLE 193
3" NIPPLE 194
3" NIPPLE OK
3" NIPPLE OK
2" COUPLING OK
MANWAY OK
CHECKED 12-11-87

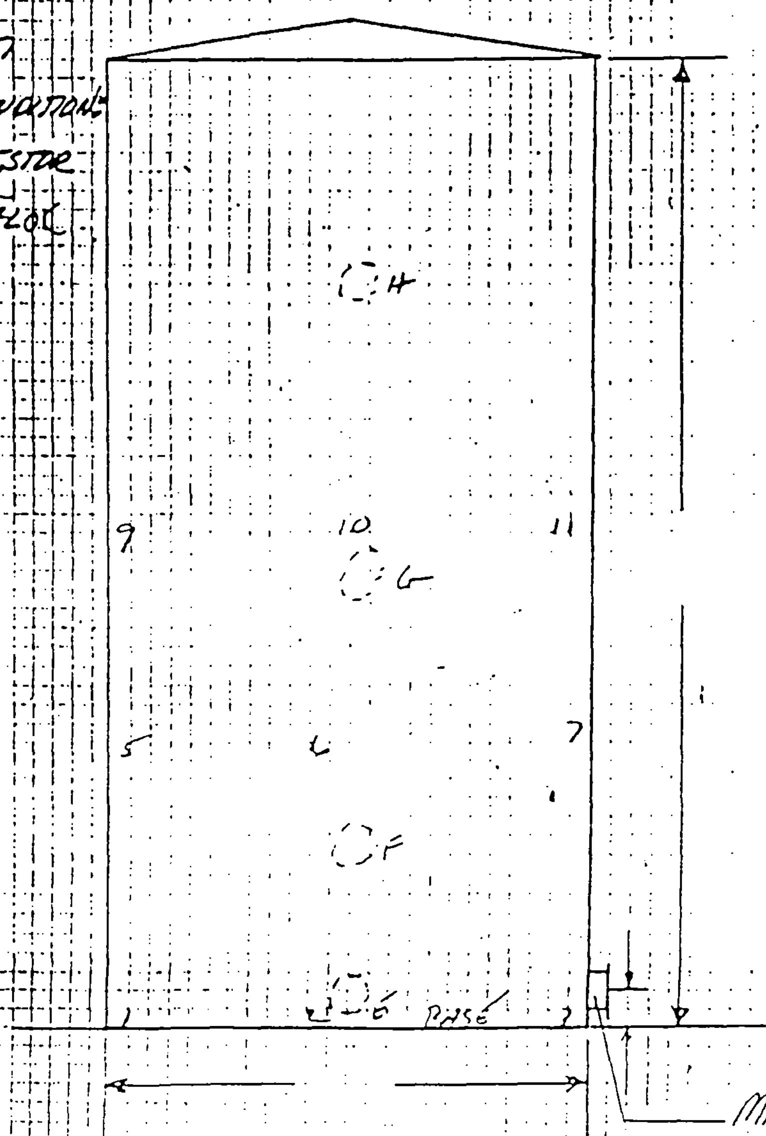
SAFETY CONTROLS AND CONDITION

BREATHER AND 2" ARRESTOR OK
GAUGE AND LIQUID SEAL OK
OK FILLED
LEVEL ALARM OK

DESIGN STANDARDS:

TANK EXTERIOR: OK





MANHEAD DIAM:

TANK: 211

INSPECTOR: JOHN SPUDVILLE

DATE: 8-11-87

MINIMUM WALL:
BASE .140
ABOVE 6' .108

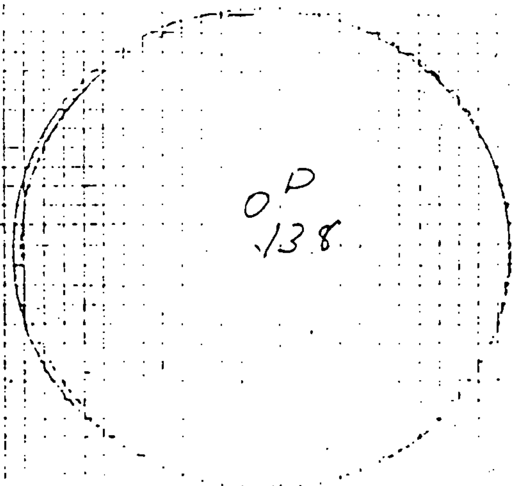
INT	HEIGHT ABOVE STR. SIDE	READING
	BASE	.239
	"	.244
	"	.249
	"	.244
	SEVEN FEET UP	.182
	"	.168
	"	.170
	"	.169
	FOURTEEN FEET UP	.178
	"	.172
	"	.179
	"	.174
	21 FEET UP	.178
		.174
		.177
		.172
	TOP SIDE OF TANK	.158
	"	.160
	"	.159
	"	.160
	TOP OF TANK	.168
	"	.160
	"	.169
	"	.168

ANK IDENT: 211

CATION: DESICCANT TANK FARM

JUNE 10, 1986

TOP VIEW



ZLES AND CONDITION:

VISUAL OK

.202 OK

.197 OK

.138 OK

FETY CONTROLS AND CONDITION:

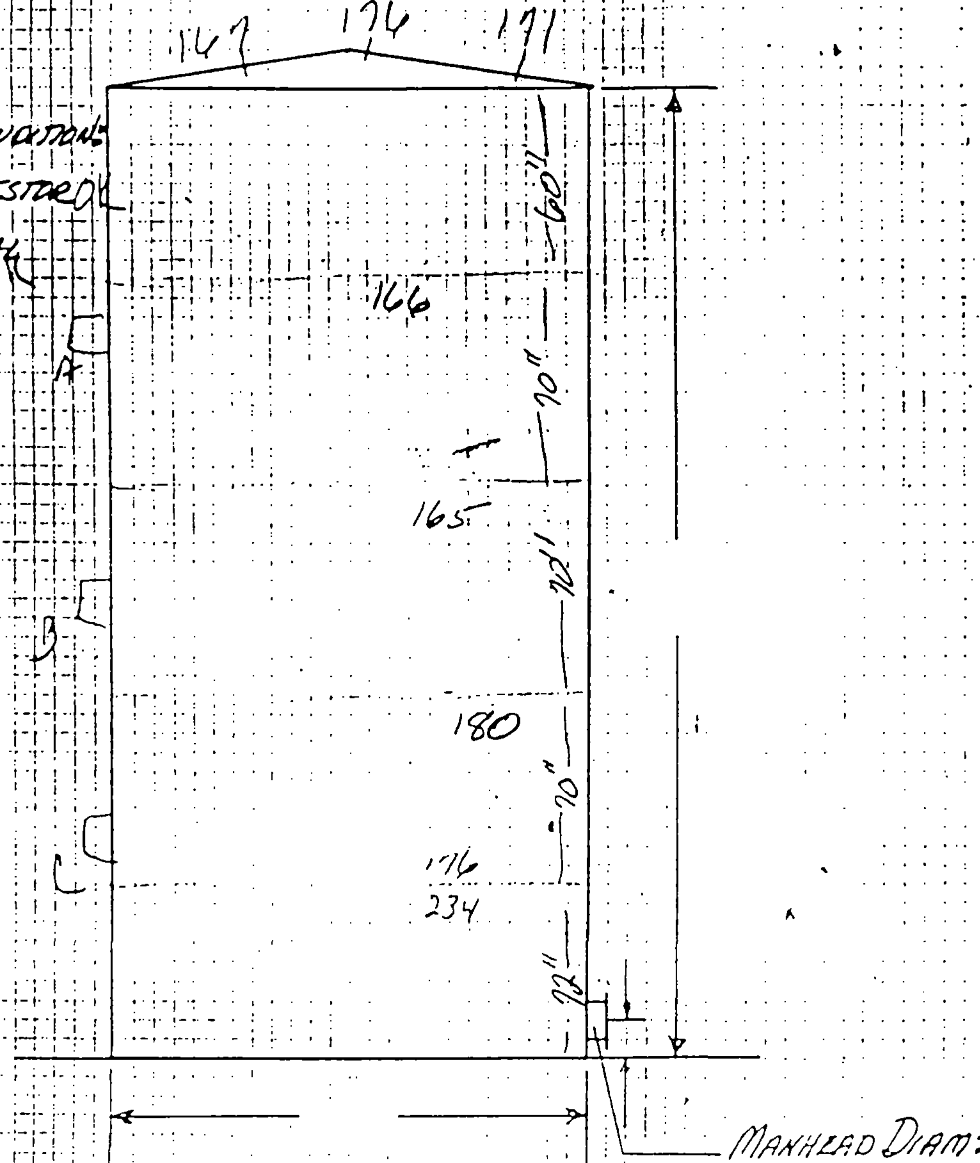
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK OK

LEVEL ALARM OK

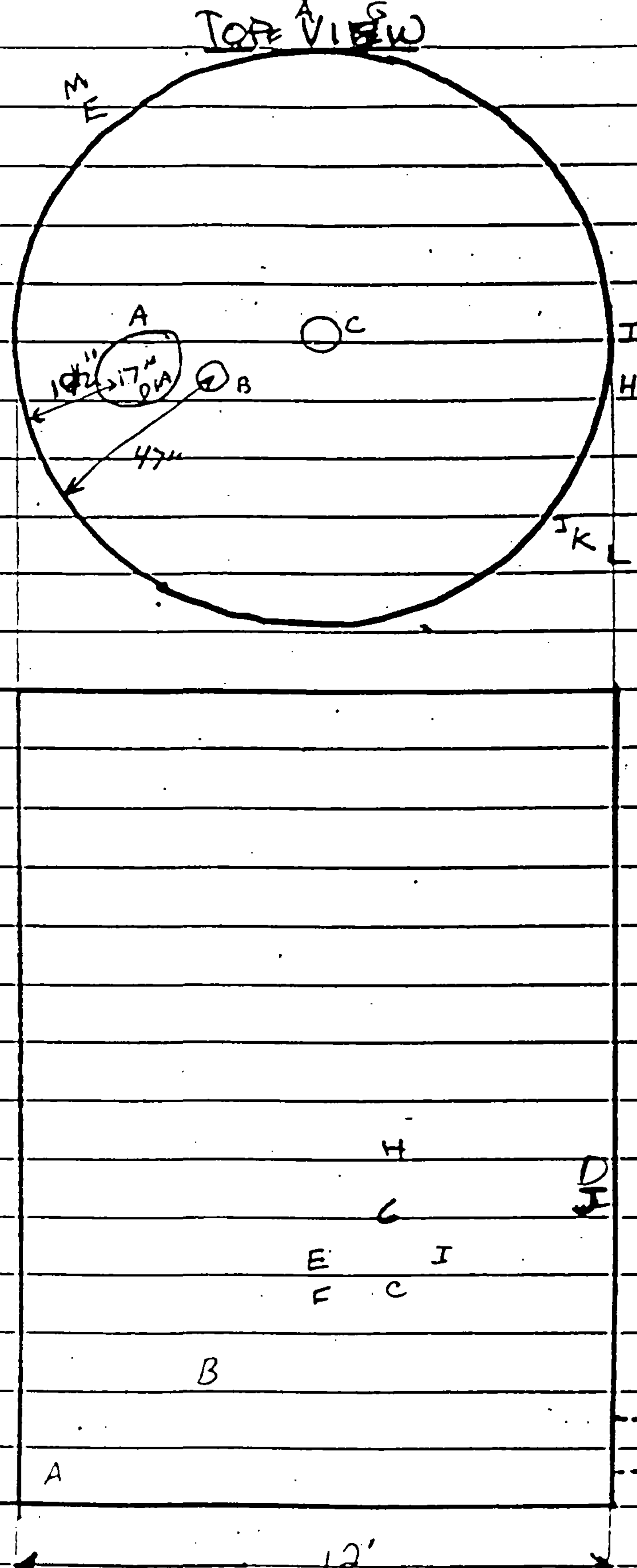
DESIGN STANDARDS:

ANK EXTERIOR: OK



TANK 211

AGITATED



N

TES— [redacted]

CATE SIDEWALL
ITTINGS IN TOP
EW

OCATE GAGE
TOP VIEW

OCATE RISER
PIPE IF
TTACHED

OCATE LADDER

LINE 85

THICKNESS READINGS

.226
.238
.233
.170
.180
~~.232~~
.180
.180
.180
.170

TOP FITTINGS

SIZE	USE
A. MANHEAD W/GA	
B. 3" VENT (THREA	
C. 2" W/RISER	
D.	

SIDE WALL CON

J	3"		6
K	3"	CAP	12
L	3"	CAP	18
M	2" PLUG		1
N	LADDER		

SIDE WALL FITTI

	SIZE	ABOVE
A.	3"	5'
B.	3"	35
C.	3"	12'
D.	3"	18'
E.	MANHEAD	
F	2" PLUG	11
~~G~~	~~2" PLUG~~	~~3~~
H	AGITATOR	2
I	2" W/VALVE	

1'9

MANHEAD DIAM —

MAY 15, 1[illegible]

JUNE 10, 1986

[T]ANK IDENT: 212

[L]OCATION: C

[N]OZZLES AND CONDITION & READING

MANWAY 3.28

2" NIPPLE .141

8" MANHOLE .287

8" BLIND 2.88

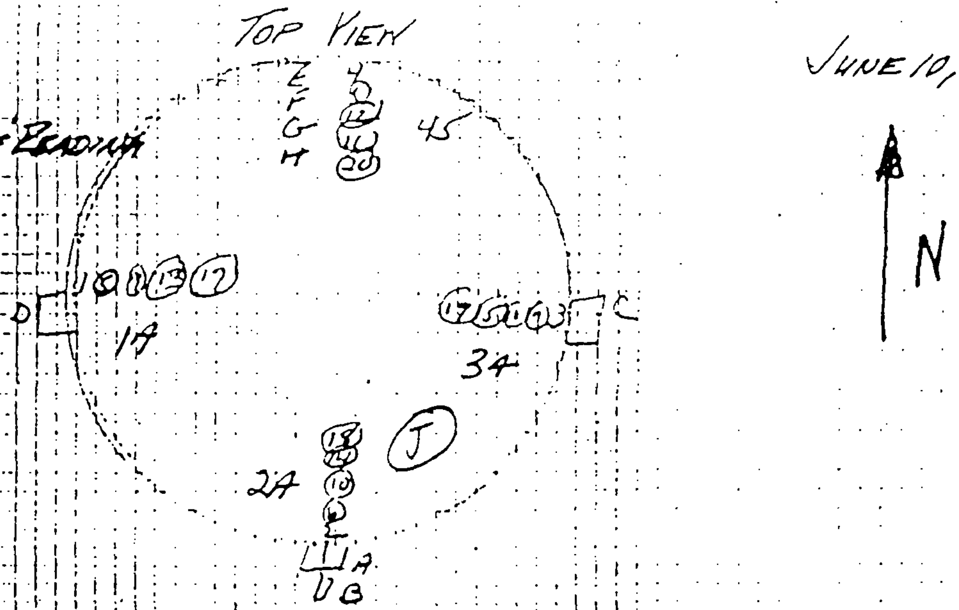
3" NIPPLE OK

3" NIPPLE OK

3" NIPPLE OK

3" NIPPLE OK

MAN WAY



8-12-87

[SA]FETY CONTROLS AND CONDITION:

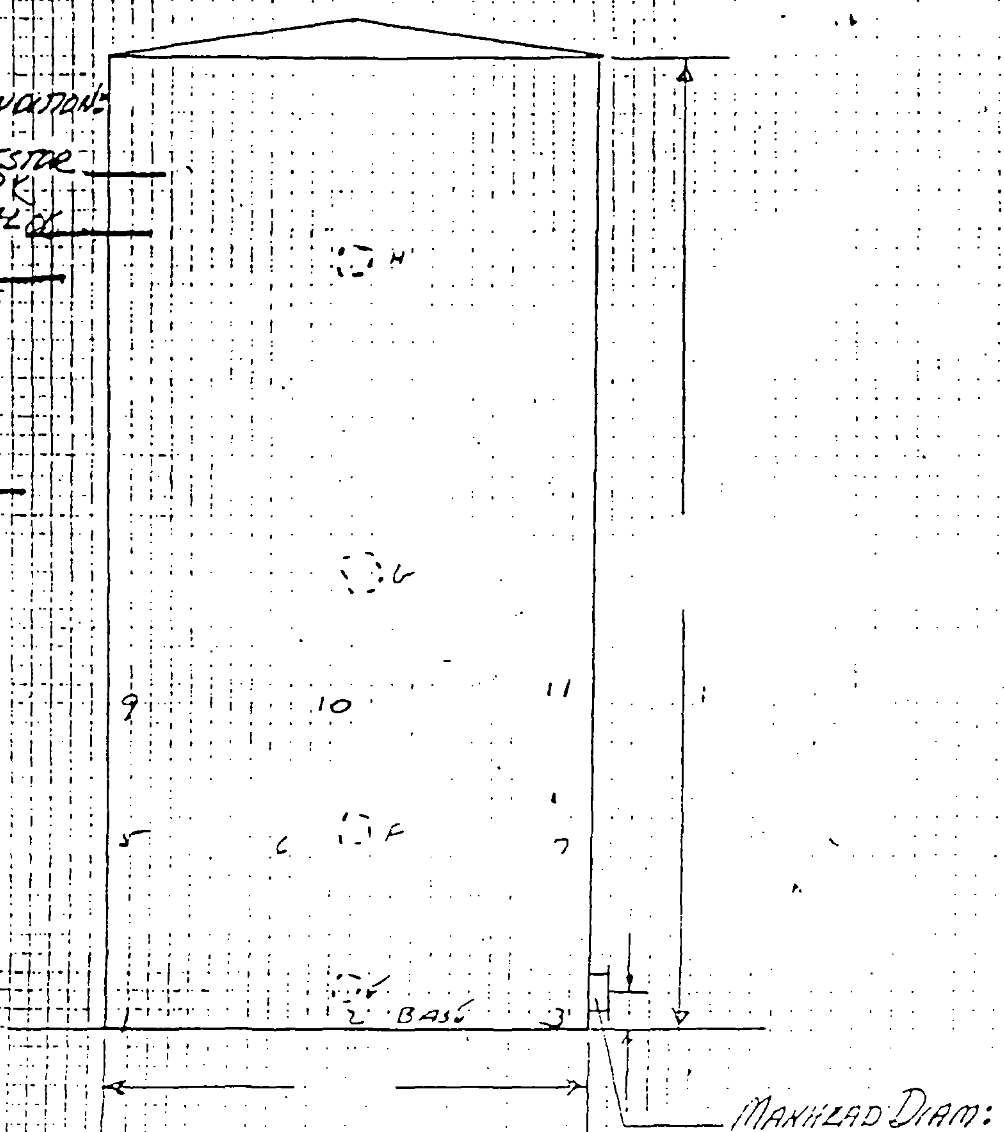
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

[D]ESIGN STANDARDS:

[TA]NK EXTERIOR: OK



TANK: 212

INSPECTOR: JOHN SPUDVILLE

DATE: MAY 15 1987

MINIMUM WALL:

BASE .148

ABOVE 6' .117

'NT	HEIGHT ABOVE STR. SIDE	READING
	BASE	.228
	"	.234
	"	234
	"	232
	SEVEN FEET UP	.162
	"	.162
	"	163
	"	.167
	FOURTEEN FEET UP	.160
	"	.163
	"	.163
	"	.167
	21 FT UP	.176
		.174
		.170
		.167
	TOP SIDE OF TK	.184
		.185
		.183
		.187
	TOP OF TK	.182
		.188
		.189
		.188

TANK PROFILE

DATE - NOV 10

JUNE 10, 1986

TANK IDENT: 212

LOCATION:

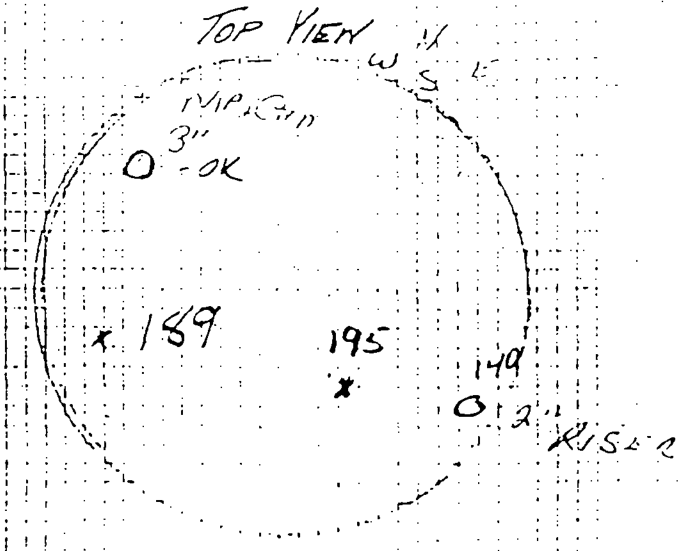
ZLES AND CONITION:

3" VISUAL OK

VISUAL OK

VISUAL OK

.142 OK



FETY CONTROLS AND CONDITION:

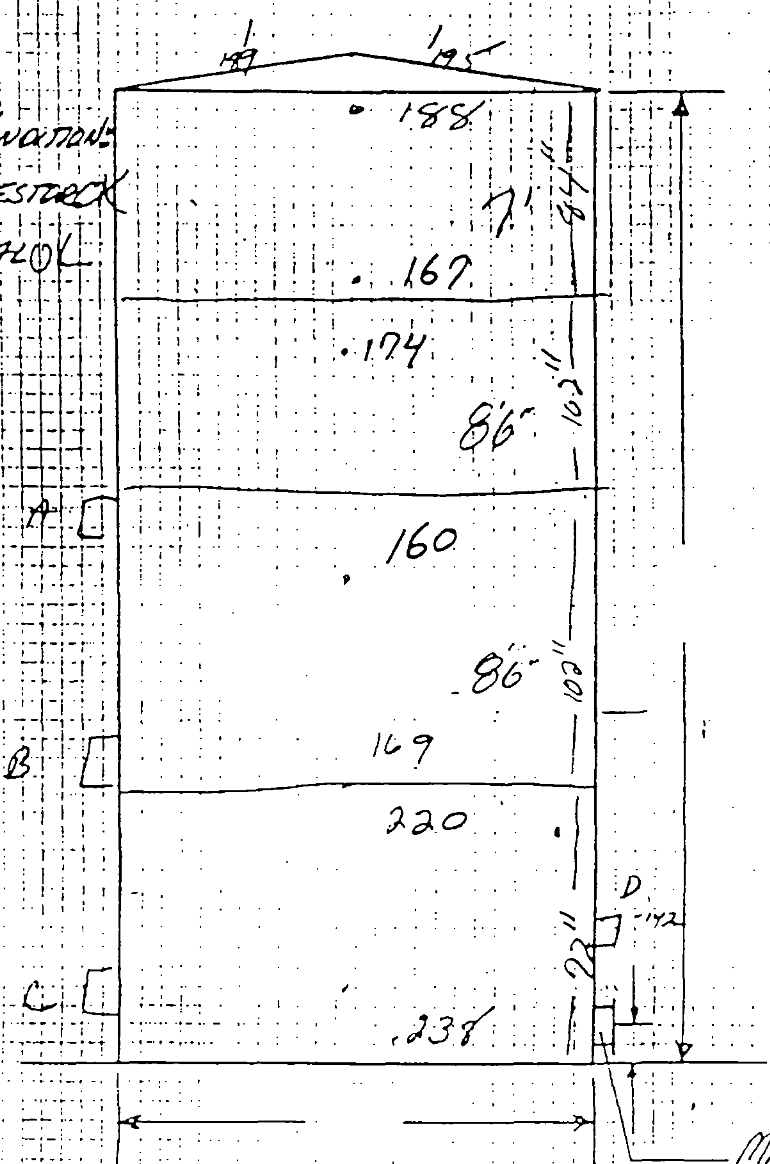
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK

OK LEVEL ALARM OK

DESIGN STANDARDS:

NK EXTERIOR: OK



MANHEAD DIAM:

[redacted] [redacted] D-[redacted] De[redacted]ipt[redacted]n o[redacted]ank[redacted]Re[redacted] to[redacted]div[redacted]al [redacted]k [redacted]il[redacted]raw[redacted]s) [redacted] [redacted] [redacted] [redacted] [redacted]

TANK IDENT	1987 PRESENT SHELL THICKNESS (IN. @ ELEV)	WORKING CAPACITY (GALLONS)	DIAMETER (FEET)	HEIGHT (FEET)
Location A				
#20	.220 DISH .243 WALL	1000	5.5	5.5
Location B				
#1A	.5625 DISH .444 WALL	2750	6.5	10
#1B	.5625 DISH .423 WALL	2750	6.5	10
#116	.285 DISH .238 WALL	10,800	12	12
#117	.313 DISH .226 WALL	10,800	12	12
#118	.314 DISH .230 WALL	10,800	12	12
#119	.311 DISH .242 WALL	10,800	12	12
#120	.305 DISH .247 WALL	6000	9	12
#121	.307 DISH .238 WALL	10,500	10	18
#122	.308 DISH .248 WALL	10,500	10	18
#123	.242 TO 6' .242 ABOVE 6'	19,500	10	33
#124	.245 TO 6' .240 ABOVE 6'	19,500	10	33
#125	.241 TO 6' .240 ABOVE 6'	19,500	10	33
#126	.240 TO 6' .232 ABOVE 6'	19,500	10	33
#1002	.162 TO 6' .175 ABOVE 6'	11,000	10.5	18

JUL 7 1987

D-2a Description of Tanks (Refer to Individual Tank Profile Drawings)
(con't) 1987 PRESENT

TANK IDENT	SHELL THICKNESS (IN. @ ELEV)	WORKING CAPACITY (GALLONS)	DIAMETER (FEET)	HEIGHT (FEET)
Location C				
#202	.241 TO 6' .170 ABOVE 6'	18,000	10.5	29
#203	.221 TO 6' .148 ABOVE 6'	16,000	10.5	27
#204	.228 TO 6' .150 ABOVE 6'	17,000	10.5	27
#205	.240 TO 6' .180 ABOVE 6'	18,000	10.5	29
#206	.236 TO 6' .215 ABOVE 6'	17,000	10.5	27
#210	.235 TO 6' .165 ABOVE 6'	23,000	12	27 1/3
#211	.237 TO 6' .175 ABOVE 6'	23,000	12	27 1/3
#212	.232 TO 6' .153 ABOVE 6'	24,000	12	29

JUL 7 1987

D- [redacted] (con't)

TANK IDENT	MATERIAL OF CONSTRUCTION	PRESSURE CONTROLS	FOUNDATION	SEAMS
Location A				
#20	A 240 316 S.S.	NONE	6" CONC	WELDED
Location B				
#1A	A 283C C.S.	STORAGE TANKS	12" CONC	WELDED
#1B	"	OPERATE AT ± .5 oz	"	"
#116	"		"	"
#117	"	BY USING POSITIVE	"	"
#118	"	AND NEGATIVE	"	"
#119	"	BREATHING VALVES	"	"
#120	"		"	"
#121	"		"	"
#122	"		"	"
#123	"		"	"
#124	"		"	"
#125	"		"	"
#126	"		"	"
#1002	"		CLAY BASE WITH 6" TO 8" GRAVEL #73	"

JUL. 7 1987

D-4B

D-2a Description of Tanks (Refer to Individual Tank Profile Drawings) (con't)

TANK IDENT	MATERIAL OF CONSTRUCTION	PRESSURE CONTROLS	FOUNDATION	SEAMS
Location C				
#202	A 283C C.S.	STORAGE TANKS OPERATE AT $\pm$ .5 oz BY USING POSITIVE AND NEGATIVE BREATHING VALVES	CLAY BASE WITH 6" TO 8" GRAVEL #73	WELDED
#203	"			"
#204	"			"
#205	"			"
#206	"			"
#210	"			"
#211	"			"
#212	"			"

JUL 7 1987

D-4C

TANK IDENT	AGE YEARS	ORIGINAL THICKNESS INCHES @ ELEVATION	PAST USAGE	RES THICKNESS INCHES AT ELEVATION	AVERAGE THICKNESS PER YEAR LOST
Location A					
#20	21	.250 DISH	MIXING	.220 DISH	.0014
		.250 SHELL	VESSEL	.243 WALL	.004
Location B			SOLVENT		
#1A	16	.5625 DISH	SOLVENT	.5625 DISH	NIL
		.500 WALLS	STORAGE	.444 WALL	.0039
#1B	16	"	"	.5625 DISH	NIL
				.423 WALL	.005
#116	14	.3125 DISH	OIL	.285 DISH	.0023
		.250 WALLS	BLENDING	.238 WALL	.0008
#117	14	"	"	.313 DISH	NIL
				.226 WALL	.0017
#118	14	"	"	.314 DISH	NIL
				.230 WALL	.0015
#119	14	"	"	.311 DISH	.0001
				.242 WALL	.0005
#120	6	.3125 DISH	NEW	.305 DISH	.0021
		.250 WALLS		.247 WALL	.0005
#121	6	"	"	.307 DISH	.0025
				.238 WALL	.0040
#122	6	"	"	.308 DISH	.0007
				.248 WALL	.0003
#123	19	.250 WALLS	FUEL OIL	.242 TO 6'	.0003
			STORAGE	.242 ABOVE 6'	.0004
#124	19	"	"	.245 TO 6'	.0003
				.240 ABOVE 6'	.0005
#125	19	"	"	.241 TO 6'	.0005
				.240 ABOVE 6'	.0006
#126	19	"	"	.240 TO 6'	.0005
				.232 ABOVE 6'	.0009
#1002	10	.187 WALLS	SOLVENT	.162 TO 6'	.0025
			STORAGE	.175 ABOVE 6'	.0012
Location C					
#202	15	.250 TO 6'	FUEL OIL	.241 TO 6'	.0006
		.187 ABOVE 6'	STORAGE	.170 ABOVE 6'	.0012

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(con't) (con't)

TANK IDENT	AGE YEARS	ORIGINAL THICKNESS INCHES @ ELEVATION	PAST USAGE	1987 PRESENT THICKNESS INCHES AT ELEVATION	AVERAGE THICKNESS PER YEAR LOST
#203	18	.250 TO 6'	FUEL OIL	.221 TO 6'	.0015
		.187 ABOVE 6'	STORAGE	.148 ABOVE 6'	.0021
#204	18	"	"	.228 TO 6'	.0012
				.150 ABOVE 6'	.0020
#205	15	"	"	.240 TO 6'	.0006
				.180 ABOVE 6'	.0005
#206	16	.250 WALLS	"	.236 TO 6'	.0008
				.215 ABOVE 6'	.0022
#210	20	.250 TO 6'	"	.235 TO 6'	.0009
		.187 ABOVE 6'		.165 ABOVE 6'	.0011
#211	20	"	"	.237 TO 6'	.0006
				.175 ABOVE 6'	.0005
#212	6	"	NEW	.232 TO 6'	.0036
				.153 ABOVE 6'	.0074

D-32A

D-2b Tank Corrosion and Erosion

Based on APl 650 A 4.1 a minimum allowable Shell thickness was developed for each storage tank.

$$t=\frac{(2.6)(D)(H-1)(G)}{(E)\ (21{,}000)} + C.A.$$

t = wall thickness in inches
D = nominal diameter of tank in feet
H = height in feet
G = specific gravity of liquid
E = joint efficenty = .7
C.A. = corrosion allowance in inches

The corrosion allowance for each tank was based on the minimum wall thickness required to secure the stored material with the maximim specific gravity shown in C-lb. (Waste in tanks) Then using the corrosion allowance, a minimum wall thickness was calculated by using a safety factor of 150%.

D-2b (con't)

The following are the calculations for each tank:

Location A

#20

With C.A. = 0 $\quad t = \frac{2.6(5.5)(4.5)(1.6)}{14700} = .007$

Safety factor: .007 x 150% = .011
With C.A. = .011 t = .018

Location B

#1A and #1B

With C.A. = 0 $\quad t = \frac{2.6(6.5)(9)(1.6)}{14700} = .016$

Safety factor: .016 x 150% = .024
With C.A. = .024 t = .040

#116,#117,#118,#119

With C.A. = 0 $\quad t = \frac{2.6(12)(11)(1.6)}{14700} = 037$

Safety factor: .037 x 150% = .056
With C.A. = .056 t = .093

#120

With C.A. = 0 $\quad t = \frac{2.6(9)(11)(1.6)}{14700} = .028$

Safety factor: .028 x 150% = .042
With C.A. = .042 t = .070

#121 and #122

With C.A. = 0 $\quad t = \frac{2.6(10)(17)(1.6)}{14700} = .048$

Safety factor: .048 x 150% = .072
With C.A. = .072 t = .120

#123,124,125 and 126

With C.A. = 0 $\quad t = \frac{2.6(10)(32)(1.0)}{14700} = .057$

Safety factor: .057 x 150% = .086
With C.A. = .086 t = .143

Location C

#210 and 211

With C.A. = 0 $\quad t = \frac{2.6\ (12)(26.3)(1.0)}{14700} = 056$

Safety factor: .056 x 150% = .084
With C.A. = .084 t = .140

D-2b (con't)

#210 and 211 Above 6'

With C.A. = 0 $\qquad t = \frac{2.6(12)(20.3)(1.0)}{14700} = .043$

Safety factor: .043 x 150% = .065

With C.A. = .065 $\qquad$ t = .108

#212

With C.A. = 0 $\qquad t = \frac{2.6(12)(28)(1.0)}{14700} = .059$

Safety factor: .059 x 150% = .089

With C.A. = .089 $\qquad$ t = .148

#212 Above 6'

With C.A. = 0 $\qquad t = \frac{2.6(12)(22)(1.0)}{14700} = .047$

Safety factor: .047 x 150% = .070

With C.A. = .070 $\qquad$ t = .117

#202 and #205

With C.A. = 0 $\qquad t = \frac{2.6(10.5)(28)(1.0)}{14700} = .052$

Safety factor: .052 x 150% = .078

With C.A. = .078 $\qquad$ t = .130

#202 and #205 Above 6'

With C.A. = 0 $\qquad t = \frac{2.6(10.5)(22)(1.0)}{14700} = .041$

Safety factor: .041 x 150% = .061

With C.A. = .061 $\qquad$ t = .102

#203 and #204

With C.A. = 0 $\qquad t = \frac{2.6(10.5)(26)(1.0)}{14700} = .048$

Safety factor: .048 x 150% = .072

With C.A. = .072 $\qquad$ t = .120

#203 and #204 Above 6'

With C.A. = 0 $\qquad t = \frac{2.6(10.5)(20)(1.0)}{14700} = .037$

Safety factor: .037 x 150% = .056

With C.A. = .056 $\qquad$ t = .093

D-2b (con't)

<u>#206</u>

With C.A. = 0 $t = \frac{2.6(10.5)(26)(1.2)}{14700} = .058$

Safety factor: .058 x 150% = .087

With C.A. = .087 t = .145

<u>#206</u> Above 6'

With C.A. = 0 $t = \frac{2.6(10.5)(20)(1.2)}{14700} = .045$

Safety factor: .045 x 150% = .067

With C.A. = .067 t = .112

Location B (Distillate Tank Farm)

<u>#1002</u>

With C.A. = 0 $t = \frac{2.6(10.5)(16)(.85)}{14700} = .025$

Safety factor: .025 x 150% = .038

With C.A. = .038 t = .063

JUN 7 1987

TANK IDENT	1987 METAL THICKNESS AT BASE	1987 METAL THICKNESS ABOVE 6'	MINIMUM WALL THICKNESS AT BASE	MINIMUM WALL THICKNESS ABOVE 6'
Location A				
#20	.220	.243	.018	NA
Location B				
#1A	.5625	.444	.040	NA
#1B	.5625	.423	.040	NA
#116	.285	.238	.093	NA
#117	.313	.226	.093	NA
#118	.314	.230	.093	NA
#119	.311	.242	.093	NA
#120	.305	.247	.070	NA
#121	.307	.238	.120	NA
#122	.308	.248	.120	NA
#123	.242	.242	.143	NA
#124	.245	.240	.143	NA
#125	.241	.240	.143	NA
#126	.240	.232	.143	NA
#1002	.159	.166	.063	NA
Location C				
#202	.241	.170	.130	.102
#203	.221	.148	.120	.093

JUL 7 1987
D-37

TANK IDENT	1987 METAL THICKNESS AT BASE	ABOVE 6'	MINIMUM WALL THICKNESS AT BASE	ABOVE 6'
#204	.228	.150	.120	.093
#205	.240	.180	.130	.102
#206	.236	.215	.145	.112
#210	.235	.165	.140	.108
#211	.237	.175	.140	.108
#212	.232	.153	.148	.117

JUL 7 19[illegible]
D-37A

APPENDIX C

STORAGE TANK ASSESSMENT AND CERTIFICATION, DISTILLATION UNITS #1, #2, #3, #7 AND TANK #1002

ATEC Associates, Inc.

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Savannah, GA
Washington, DC
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Affiliates:
Alexandria, VA
Norfolk, VA

March 29, 1988
File 8-3037

American Chemical Services, Inc.
ATTN: Mr. John J. Murphy, Vice President
420 S. Colfax Avenue
P.O. Box 190
Griffith, IN 46319

<u>REPORT</u>
Storage Tank Assessment and Certification
American Chemical Service, Inc.
Distillation Units #1, #2, #3, #7 and Tank #1002
Griffith, Indiana

Dear Mr. Murphy:

We have completed our assessment and certification of five (5) above-ground RCRA waste storage/treatment vessels. These vessels include four (4) distillation units and one (1) storage tank. This work was completed in general accordance with our work confirmation letter dated February 20, 1988.

A narrative summary of our evaluation of these vessels is presented in the body of this report. Based on our evaluation, we certify that in our opinion, these tank systems are adequately designed, currently have sufficient structural strength, and are acceptable for storage and distillation of the specified materials.

We trust this information is sufficient for your needs.

Very truly yours,
Atec Associates, Inc.

John M. McBride
Hydrogeologist

John W. Weaver II, P.E.
Vice President

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Storage Tank Assessment and Certification
American Chemical Services
Distillation Units #1, #2, #3, #7 and Tank #1002
Griffith, Indiana

1.0 INTRODUCTION

1.1 General

ATEC Associates, Inc. (ATEC) was retained by American Chemical Services (ACS) to prepare this written assessment of the above referenced RCRA storage/treatment tank facilities currently in use at ACS in Griffith, Indiana. This assessment is based upon a review of design standards, ACS vessel inspection records and reports, plumbing and piping pressure test results, hydrostatic test results, and an on-site visual inspection of each tank system. We did not perform testing or welds or perform independent design calculations.

This assessment report was prepared in accordance with the requirements outlined in 40 CFR 264.191. To address current regulatory interpretations of these regulations, we have also reviewed and addressed more detailed requirements set forth in the "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems", U.S. EPA Office of Solid Waste, December, 1986.

1.2 Organization

The results of our assessment and findings are presented in the body of this report. Pertinent data, including tank I.D. numbers, installation dates, capacities, thickness summarys and tank contents are summarized in the "Tables" Section. Results of pressure tests and our visual inspections for each vessel are presented in Appendix A. General tank information, including company inspection reports and a written assessment of tank shell thicknesses are presented in Appendix B.

1.3 Subject of Assessment and Certification

In summary, four (4) distillation units and one (1) waste storage tank are addressed by this assessment report. A list of tanks and their I.D. numbers is presented in Table 1. The RCRA storage treatment tank locations are shown in Figure 1.

1.4 Design Standard Assessment

Based on our visual observations and conversations with Mr. John J. Murphy of ACS, storage tank #1002 was designed in accordance with the document API Standard 650, "Recommended Rules for Design and Construction of Large, Welded, Low-Pressure Storage Tanks." Distillation units #1, #2, #3, and #7 were designed and fabricated to ASME standards.

1.4.1 Shell Thickness Testing

All tank shells were tested for thickness of the tank walls and roof by ACS personnel during the summer of 1987. Thicknesses were measured using a Parametrics Ultrasonic Thickness Gauge, Model 5226. Each tank was measured by first scraping the painted surface to the bare metal. A thin film of conductivity grease was applied to the area and the measurement was taken. The equipment was recalibrated for each tank from a standard block. The number of points measured for each tank was based on the variation of the readings.

For dish bottom tanks, a minimum of three readings were taken on the bottom dish, one about 12" from the bottom nozzle, one halfway to the sidewall, and one 12" from the sidewall. Further, readings were obtained 6 inches up the sidewall, one on either side of the first seam and one on either side of the second seam. If discrepancies developed, more readings were taken. The flat bottom tanks were measured at the following locations: Two 6" up the sidewall (one adjacent to the transfer nozzle), one one either side of the first seam, one on either side of the second seam and one on the either side of the third seam. Again, if discrepancies developed more readings were taken. The recorded metal thicknesses were based on the minimum readings.

Tank thickness test results indicate that tank wall thinning has been consistently small. Five verification measurements per tank were taken by ACS personnel and observed and recorded by ATEC on March 24, 1988. Results of these verification measurements are in Table 2. These verification measurements deviated a maximum of 6.2 percent from earlier measurements, with a absolute mean variation of approximately 2 percent.

1.5 Hazardous Characteristics

According to U.S. EPA Guidance, an assessment of hazardous characteristics for handled wastes should address the compatibility of handled wastes with tank and or liner materials. Our compatibility assessment was prepared by evaluating loss of tank thickness as documented by ACS personnel in the attachment reproduced in Appendix B.

The tanks subject to this assessment are constructed of A 283C carbon steel. With the exception of tank #1002, average yearly shell thickness loss rates are less than the "conservative" limit of 0.002 inches per year prescribed in the U.S. EPA guidance document [2]. Table 5 is a summary of tank thickness loss records. We therefore believe that these tanks are sufficiently compatible for continued similar use.

Tank #1002 lost an average of 0.0028 inches of wall thickness per year. To evaluate this tank, ACS has calculated a minimum allowable shell thickness using the method outlined in API 650 A 4.1. Using this method, ACS has determined that current (1987) shell thicknesses for this tank still exceed the minimum API thickness requirements (including a corrosion allowance) by a factor of about 3.5. Based on the calculated shell thickness loss rate, tank #1002 should maintain a sufficient shell thickness for approximately thirty-three (33) years. Thus, with annual shell thickness monitoring, we believe that this tank also exhibits sufficient compatibility for continued similar use.

1.6 Leak Test Results

Stills #1 and #7 and tank #1002 was visually observed while operating under nuetral pressure at full operating capacity. Stills #2 and #3 were visually observed while operating at a negative pressure of negative 15 inches of mercury. No visible signs of leakage were observed for these tanks during these tests. Further, these observations serve to demonstrate that these tanks posses sufficient strength to contain their full hydrostatic loads.

The two inch pipeline between tank #1002 and the boiler unit was pressureized with product to 80 psi. All piping, valves and joints were observed for signs of product leakage. No leaks were detected during this test.

Ancillary equipment for the distilling units subject to this assessment was pressure tested for tightness using a method developed specifically for the system. The ancillary equipment is defined as all piping, valves, joints, gaskets, and pumps associated with the distillation farm, within the boundaries shown in Figure 1. Nitrogen was applied to each of the lines at a minimum of 25 pounds per square inch.

A soap water mixture was applied to the pumps, joints, welds, and valves of the entire system to facilitate detection of nitrogen leaks. Points in the system which indicated loss of nitrogen were immediately repaired and retested to assure tightness. At completion of pressure testing, all ancillary equipment within the distillation farm passed this leak test.

1.7 Visual Inspection Results

The tank systems subject to this assessment were physically inspected on March 23, 1988 by ATEC. The check list used for the inspection was based on the publication "Guide for Inspection of Refinery Equipment, Chapter VIII - "Atmosheric and Low-Pressure Storage Tanks" published by the American Petroleum Institute. Listed below are the items physically inspected at each system.

Anchor bolts - where possible
Welds
Pipe supports
Nozzle connections
Tank walls
Roof foundations
Vents and controls on tank roof
Gauges in operation
Protective coating
Indication of any leaks
Name plates
General Housekeeping

All four distillation units, #1, #2, #3, #7 and tank 1002 systems appeared to be in a good state of repair. We observed no deficiencies that appeared to affect the structural integrity of the tank systems. The check list from the inspection of each tank is included in Appendix A.

1.8 Qualifications

At the time of this assessment, vessels and ancillary equipment subject to this certification were assessed to be free of leaks, structurally sound, and in a good state of general repair. In my opinion, the extent and scope of this study is in general accordance with the EPA guidance as expressed in the

U.S. EPA "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems," December, 1986.

However, with the passage of time, site conditions or equipment usage conditions can be subject to change. Therefore, periodic reviews of system conditions should be completed. These reviews should include continuation of routine and non-routine inspection and maintenance of all vessels (including semi-annual shell thickness monitoring) and ancillary equipment used to store, treat, or handle hazardous materials. If the usage or application of the facilities described in this report are at any time changed materially from the conditions described in this assessment, or if during operation, routine maintenance, or inspections it is discovered that information presented in this assessment is incorrect, of if observed leakage does occur, we should be informed immediately since the validity of our findings may be affected.

1.9 Certification Statement for Existing Tank Systems

I, John W. Weaver II, P.E. Certify for ATEC Associates, Inc., the following. These findings were obtained in accordance with standard petroleum industry and standard engineering practices. No other warranties are expressed or implied:

1. I am a qualified registered professional engineer and am not an employee of American Chemical Services, Inc. or an American Chemical Services, Inc. subsidiary.

2. The term "Tank System" in this assessment and certification refers to the following tank systems and distillation units subject to this assessment: #1002, #1 still, #2 still, #3 still, and #7 still as identified and located in this assessment report.

3. In my opinion, based on my review of, or the review of others under my direction, the Design Information for these Tank Systems indicates that the Tank Systems have sufficient structural integrity and are currently acceptable for storing the materials identified in this assessment report.

4. In my opinion, the tank systems are adequately designed and currently have sufficient structural strength and compatibility with stored materials to ensure that they will not collapse, rupture, or fail.

I certify under penalty of law that this document and all attachments were prepared by me of under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John W. Weaver II, P.E.

19478

Professional Engineer's Number

Vice President

Title

ATEC Associates, Inc.

Firm

List of References

1. American Petroleum Institute, Publication #650, "Recommended Rales for the Design and Construction of Large, Welded, Low-Pressure Storage Tanks.

2. United States Environmental Protection Agency, Office of Solid Waste, "Technical Resource Document for the Storage and Treatment of Hazardous Waste in Tank Systems", December 1986.

TABLE 1

Listing of Vessels Subject to Assessment

Tank Number	Year Installed	Capacity (gal)	Contents *1	Design *2
1002	1986	11,000	a	c
#1 Still	1977	5,500	b	a
#2 Still	1977	5,500	b	a
#3 Still	1977	3,500	b	a
#7 Still	1981	5,500	b	b

*1) a - Methanol, Separably, Alcohol, Butanol.

b - Methylene Chloride, 1,1,1 Trichloroethane, Trichloroethylene, Perchloroethylene, Acetone, Methanol, Methyl Ethyl Keton, Separably, alcohol, Toluene, Hexane, Methyl Isobutyl Ketone, Butyl Acetate, Xylene, Mineral Spirits, Butyl Cellusolve, Butanol, Ethyl Acetate.

*2) a - Vertical on legs.

b - Horizontal on saddles.

c - Vertical on the ground.

TABLE 2
Verification of Shell Thickness Testing

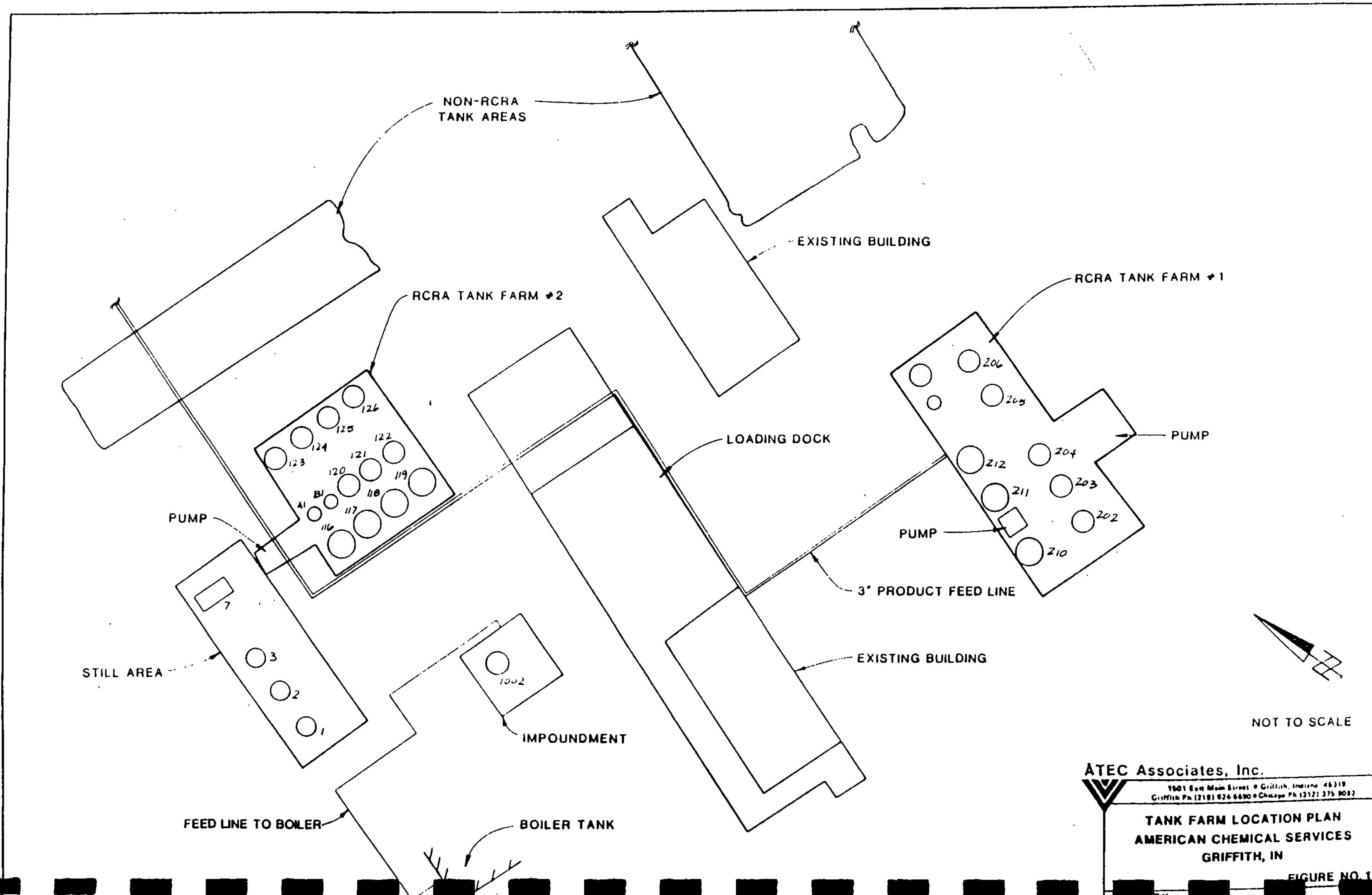
American Chemical Services
Tank Assessment
Tank Thickness Summary
File 8-3037

Tank Number	Measuring Point Elevation (ft)	Tank Side	Thickness (in) 09/87	Thickness (in) 03/24/88	Change Thickness (in)#1	Change Thickness %
1002	5	N	0.162	0.163	0.001	0.617
	5	W	0.163	0.160	-0.003	-1.840
	5	S	0.156	0.152	-0.004	-2.564
	5	E	0.156	0.155	-0.001	-0.641
#1 Still	Bottom	E	1.154	1.225	0.071	6.153
				Mean:	0.011	1.969

#1 - A positive thickness change indicates an increase in tank wall thickness. A negetive thickness change indicated tank wall thinning.

TABLE 3
Tank Thickness Testing Information

Tank Number	Age (years)	Original Thickness (in)	Present Thickness (in)	Average Thickness loss/yr	Calculated Minimum Thickness	Years To Minimum Thickness	Year Installed
1002	11	0.187	0.156	0.0028	0.063	33.000	1986
#1 Still	43	1.250	1.225	0.0006	0.310	1573.800	1977
#2 Still	43	0.500	0.476	0.0006	0.310	297.417	1977
#3 Still	43	0.500	0.424	0.0018	0.245	101.276	1977
#7 Still	8	0.313	0.312	0.0001	0.222	1440.000	1981



ATEC Associates, Inc.

TANK FARM LOCATION PLAN
AMERICAN CHEMICAL SERVICES
GRIFFITH, IN

FIGURE NO. 1

APPENDIX A

Pressure Testing

Plant Site: AMERICAN CHEMICAL File No: 8-3037
Tank System #: 1002
Date: 3/24/88
Inspected by: STEVEN STANFORD

1) Testing method: Tank and line to boiler pressurized to 80 psi by magnetic pump.

2) Leaks detected none

3) Remedial action - results (if appropriate)

Pressure Testing

Plant Site: AMERICAN CHEMICAL File No: 8-3037
Tank System #: ANCILLARY lines to Stills
Date: 3/24/88
Inspected by: STEVEN STANFORD

1) Testing method: pressurized by N_2 to 30 psi

2) Leaks detected -
1) leak at one (1) valve packing

3) Remedial action - results (if appropriate)
packing tightened until leak was stopped.

Pressure Testing

Plant Site: AMERICAN CHEMICAL File No: B-3037
Tank System #: #1 Still
Date: 3/24/88
Inspected by: STEVEN STANFORD

1) Testing method: Observed while operating under neutral pressure

2) Leaks detected none

3) Remedial action - results (if appropriate)

Pressure Testing

Plant Site: ACS File No: 8-3037

Tank System #: #2 Still

Date: 3/24/88

Inspected by: STEVEN STANFORD

1) Testing method: Observed while at -15" Hg pressure.

2) Leaks detected none detected

3) Remedial action - results (if appropriate)

Pressure Testing

Plant Site: ACS

File No: 8-3037

Tank System #: #3 Still

Date: 3/24/88

Inspected by: STEVEN STANFORD

1) Testing method: Observed while under -15" Hg pressure

2) Leaks detected none detected

3) Remedial action - results (if appropriate)

Pressure Testing

Plant Site: ACS File No: 8-3037

Tank System #: #7 Still

Date: 3/24/88

Inspected by: STEVEN STANFORD

1) Testing method: observed while under neutral pressure

2) Leaks detected none detected

3) Remedial action - results (if appropriate)

Visual Inspection

Tank System # 1002 Plant Site: ACS

Date: 3/24/88 File No: 8-3037

Inspected by: SS

Item

1) Weld breaks - none detected

2) Punctures - none detected

3) Scrapes of protective coatings - none, freshly painted

4) Cracks none detected

5) Corrosion - slight on surface, painted over

6) Loose pipe connections - indications of leaks - none detected

7) Others - Thickness testing

+5' - N side 0.163" S side - 0.155"

W side 0.160" E side - 0.155"

8) General House keeping - Excellent

Visual Inspection

Tank System # 1-Still

Date: 3/24/88

Inspected by: SS

Plant Site: ACS

File No: Z-3037

Item

1) Weld breaks ✗/

2) Punctures ✗/

3) Scrapes of protective coatings - could not be verified due to tank insulation

4) Cracks ✗/

5) Corrosion - could not be checked due to tank insulation.

6) Loose pipe connections - indications of leaks ✗/

7) Others ✗/ - Vessel is insulated so that direct inspection of these parameters was not possible. But there was no sign of leakage below the elevated vessel.

8) General House keeping - excellent

Visual Inspection

Tank System # 2-56-11 Plant Site: ACS
Date: 3/24/88 File No: 8-3032
Inspected by: SS

Item

1) Weld breaks ≠/

2) Punctures ≠/

3) Scrapes of protective coatings - could not be verified due to tank insulation

4) Cracks ≠/

5) Corrosion - could not be verified due to tank insulation

6) Loose pipe connections - indications of leaks ≠/

7) Others ≠/ Vessel is insulated, thus direct inspection of these parameters is not possible. But there was no sign of leakage below the elevated vessel

8) General House keeping - excellent

Visual Inspection

Tank System # 3-Still

Date: 3/24/88

Inspected by: SS

Plant Site: ACS

File No: 8-3037

Item

1) Weld breaks ≠/

2) Punctures ≠/

3) Scrapes of protective coatings - could not be verified due to tank Insulation

4) Cracks ≠/

5) Corrosion - could not be verified due to tank insulation

6) Loose pipe connections - indications of leaks ≠/

7) Others ≠/ Vessel is insulated, thus direct inspection of these parameters is not possible. But there was no sign of leakage below the elevated vessel

8) General House keeping - excellent

Visual Inspection

Tank System # 2-Still

Date: 3/24/88

Inspected by: SS

Plant Site: ACS

File No: 8-3032

Item

1) Weld breaks */

2) Punctures */

3) Scrapes of protective coatings - could not be verified due to tank insulation

4) Cracks */

5) Corrosion - could not be verified due to tank insulation

6) Loose pipe connections - indications of leaks */

7) Others */ Vessel is insulated, thus direct inspection of these parameters is not possible. But there was no sign of leakage below the elevated vessel

8) General House keeping - excellent

APPENDIX B

TANK PROFILE

DATE - 6-15-81

JUNE 10, 1986

TANK IDENT: 1002

CATION: BATCH MFG TK FARM

% LES AND CONDITION & READING

3" COUPLING - 390

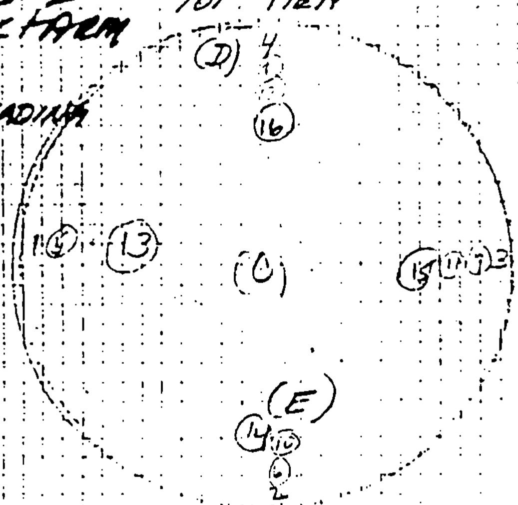
3" COUPLING - 356

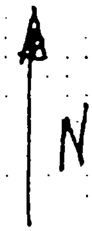
MANHEAD 36"

3" RISER

3" CONSERVATION VENT

TOP VIEW





CHECKED 8-12-87

FETY CONTROLS AND CONDITION:

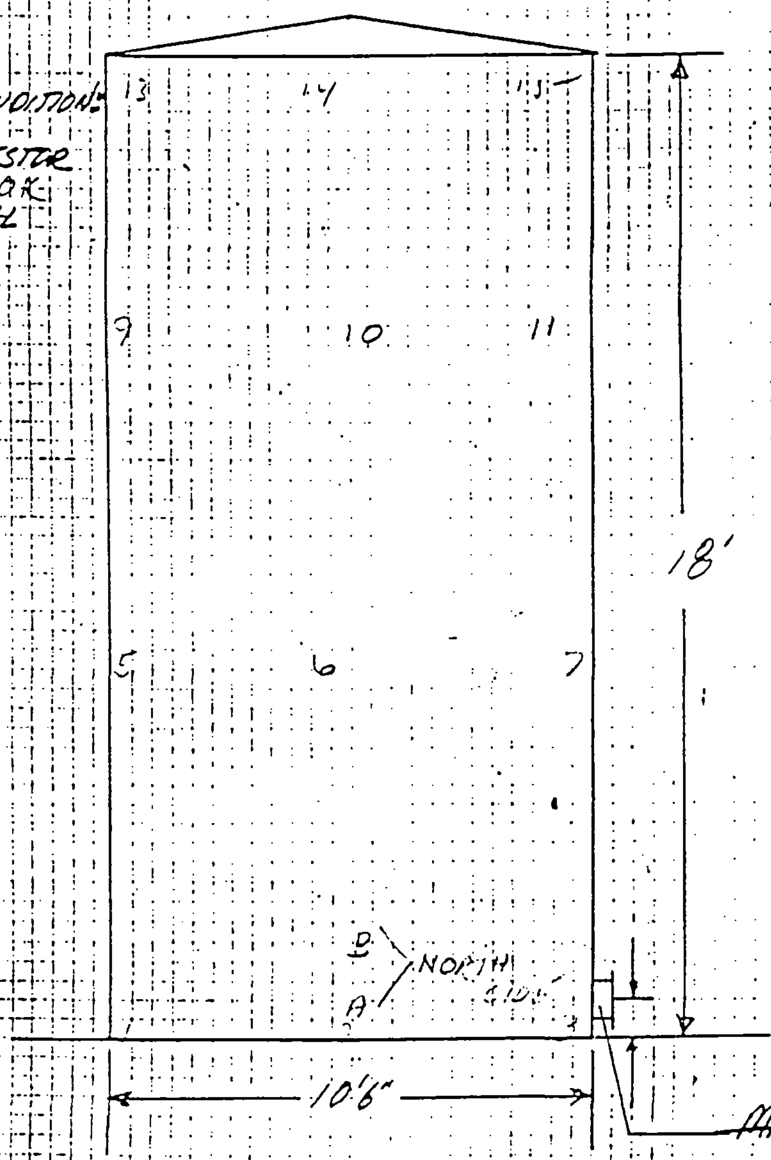
BREATHER AND 2" ARRESTOR OK

GAUGE AND LIQUID SEAL OK FILLED

LEVEL ALARM OK

SSIGN STANDARDS:

NK EXTERIOR: OK



(1)

TANK: ~~1003~~ 1002

INSPECTOR: John Spudville

DATE: 6-15-87

MINIMUM WALL:

.063 @ BASE

POINT	HEIGHT ABOVE STR. SIDE	READING
1	BASE OF TANK	.162
2	"	.163
3	"	.156
4	"	.156
5	SIX FEET ABOVE BASE	.160
6	"	.159
7	"	.181
8	"	[illegible]
9	THIRTEEN FEET ABOVE BASE	.181
10	"	.181
11	"	.182
12	"	.179
13	TOP SIDE OF TANK	.182
14		.181
15		.182
		.178
[illegible]	TOP OF TANK	.132
[illegible]		.132
[illegible]		.135
[illegible]		.137

(1)

TANK PROFILE

DATE: 6-18-87

TANK IDENT: #1 STILL

LOCATION: D

NOZZLES AND CONDITION & READING

AWAY 1.777

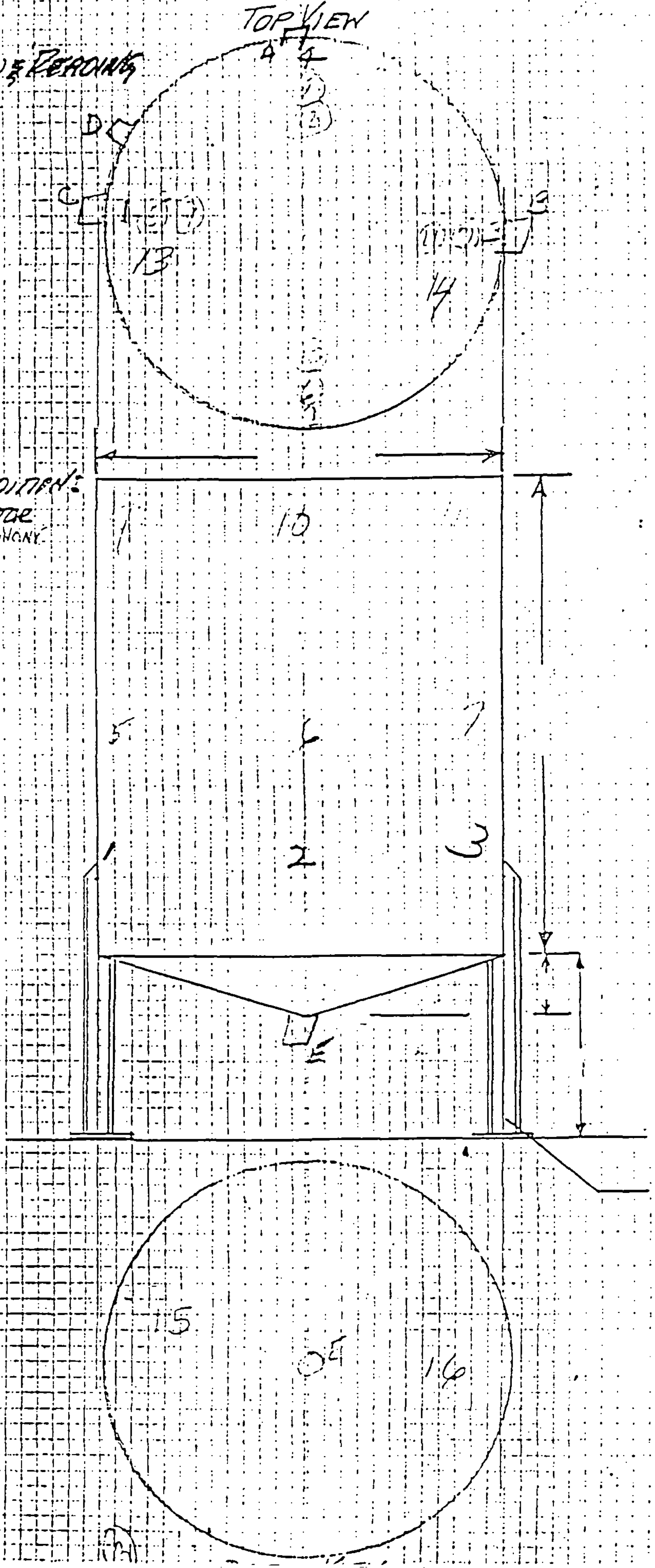
AIR PUMP .330

3" NIPPLE .714

2" OK

3" NIPPLE .752

JUNE 10, 1986



SAFETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR NONE

GAUGE AND LIQUID SEAL NONE

LEVEL ALARM NONE

DESIGN STANDARDS:

TANK EXTERIOR: OK

LEG DIAMETER:

NUMBER:

TANK: #1 STILL

INSPECTOR: JOHN SPUDVILLE

DATE: 1-18-87

MINIMUM WALL:
BOTTOM SEAM .310

HEIGHT ABOVE STR. SIDE	READING
FOUR FEET UP	1.324
"	1.314
"	1.245
"	1.254
14' UP	1.180
	1.189
	1.194
	1.196
TOP SIDE OF STILL	1.120
	1.128
	1.168
	1.158
VAPOR LINE	.148
TOP OF STILL	.1.002
	1.0[illegible]
	1.148
BOTTOM OF STILL	[illegible]

(4)

TANK IDENT: #2 STILL

6-15-87

LOCATION: D

JUNE 10, 1986

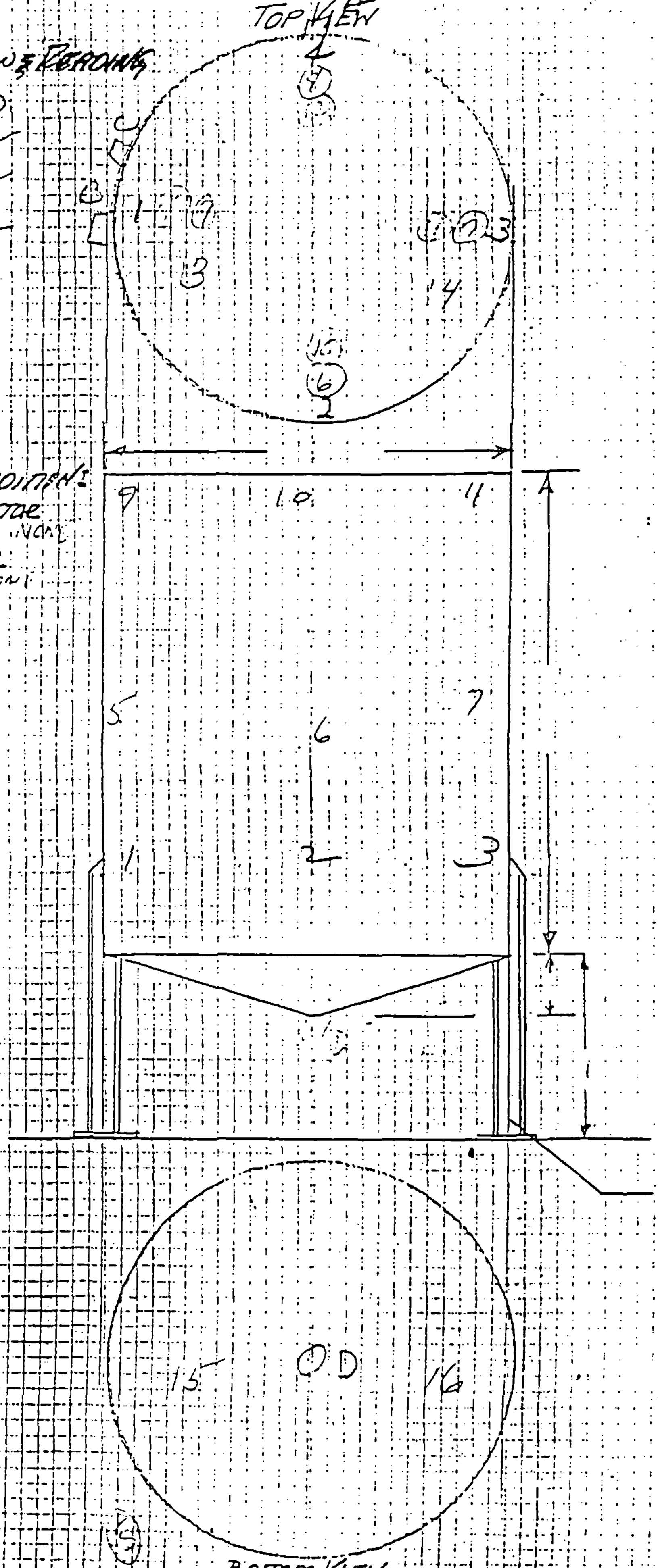
NOZZLES AND CONDITION & READINGS

1 MANWAY .980

AIR PUMP .325

NIPPLE .565

3/4" NIPPLE .672



SAFETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR NONE

GAUGE AND LIQUID SEAL NONE

LEVEL ALARM NONE

DESIGN STANDARDS:

TANK EXTERIOR: OK

TANK: #2 STILL

INSPECTOR: JOHN SPOUVILLE

DATE: 6-15-87

MINIMUM WALL:

Bottom Seam .310

NT	HEIGHT ABOVE STR. SIDE	READING
	FOUR FEET UP	.472
	"	490
3	"	.477
	"	.480
	FOURTEEN FEET UP	.457
		.452
		.466
		.456
8	TOP SIDE	.448
		451
		.478
12		.450
	HACK LINE	.150
13	TOP OF STILL	.466
14		.500
15	BOTTOM OF STILL	.528
16		.564

0

TANK PROFILE — 6-15-87

TANK IDENT: #3 STILL

LOCATION: D

JUNE 10, 1986

NOZZLES AND CONDITION & ~~READINGS~~

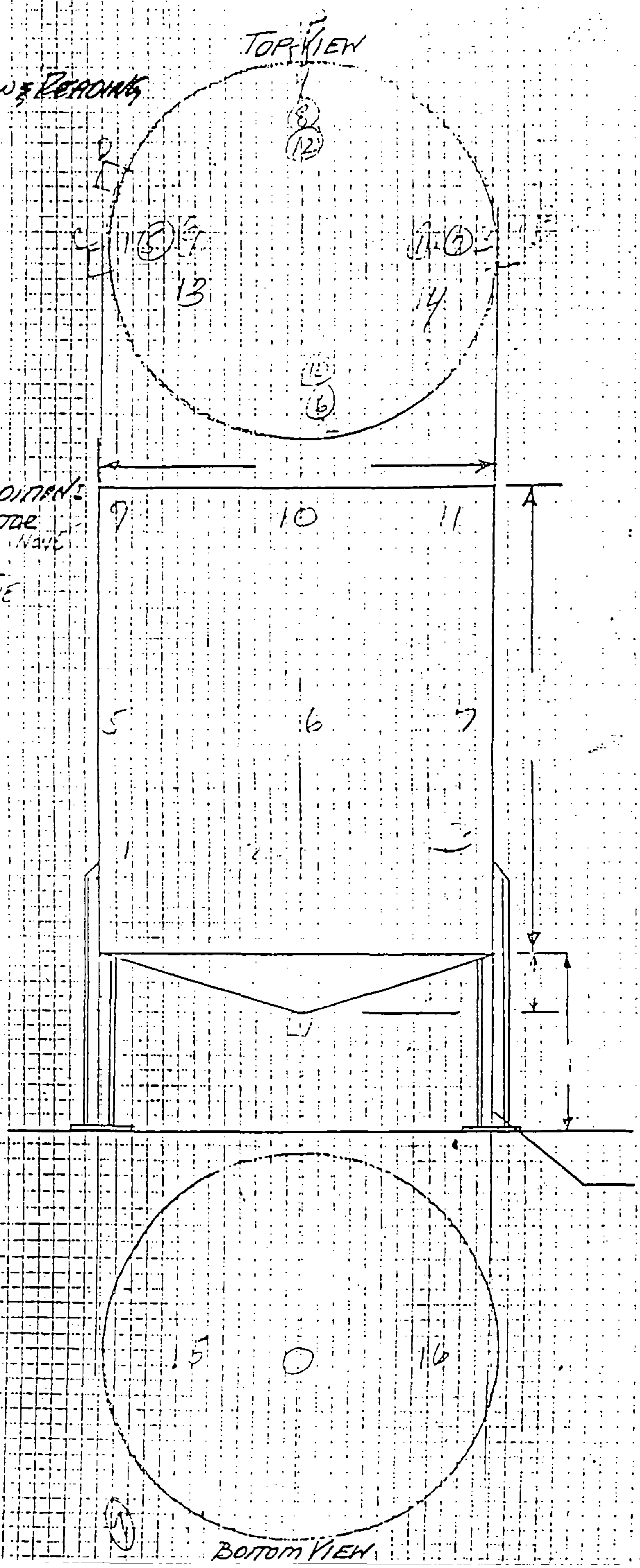
N WAY .957

... PUMP .308

3" NIPPLE

NIPPLE

3" NIPPLE



SAFETY CONTROLS AND CONDITION:

BREATHER AND 2" ARRESTOR NONE

GAUGE AND LIQUID SEAL NONE

LEVEL ALARM NONE

DESIGN STANDARDS:

TANK EXTERIOR: OK

LEG DIAMETER:

NUMBER:

TANK: #3 STILL

INSPECTOR: JOHN SPUDVILLE

DATE: 1-15-87

MINIMUM WALL:

BOTTOM SEAM .295

VT	HEIGHT ABOVE STR. SIDE	READING
1	4 FEET UP	.508
2	"	415
3	"	416
4	"	117? — ONE FOOT ABOVE 416
		ONE FOOT BELOW 416
	30½" TOP OF MANWAY	ONE FOOT [illegible] 437
	FOURTEEN FEET UP	415
		400
		406
		400
	TOP SIDE OF STILL	.400
		.366
		.397
		.366
VAPOR	LINE 145	
	TOP OF STILL	432
		.450
	BOTTOM OF STILL	.557
		.565

INSPECTED DURING AN INTERNAL — WAS A FALSE READING. OK [illegible]

6-15-87

TANK IDENT: # 7 STILL (HORIZONTAL)

LOCATION: D

JUNE 10, 1986

…ZLES AND CONDITION & READINGS

1. 1½"NIPPLE WITH VALVE

2. 2" NIPPLE "

3.

SAFETY CONTROLS AND CONDITION:

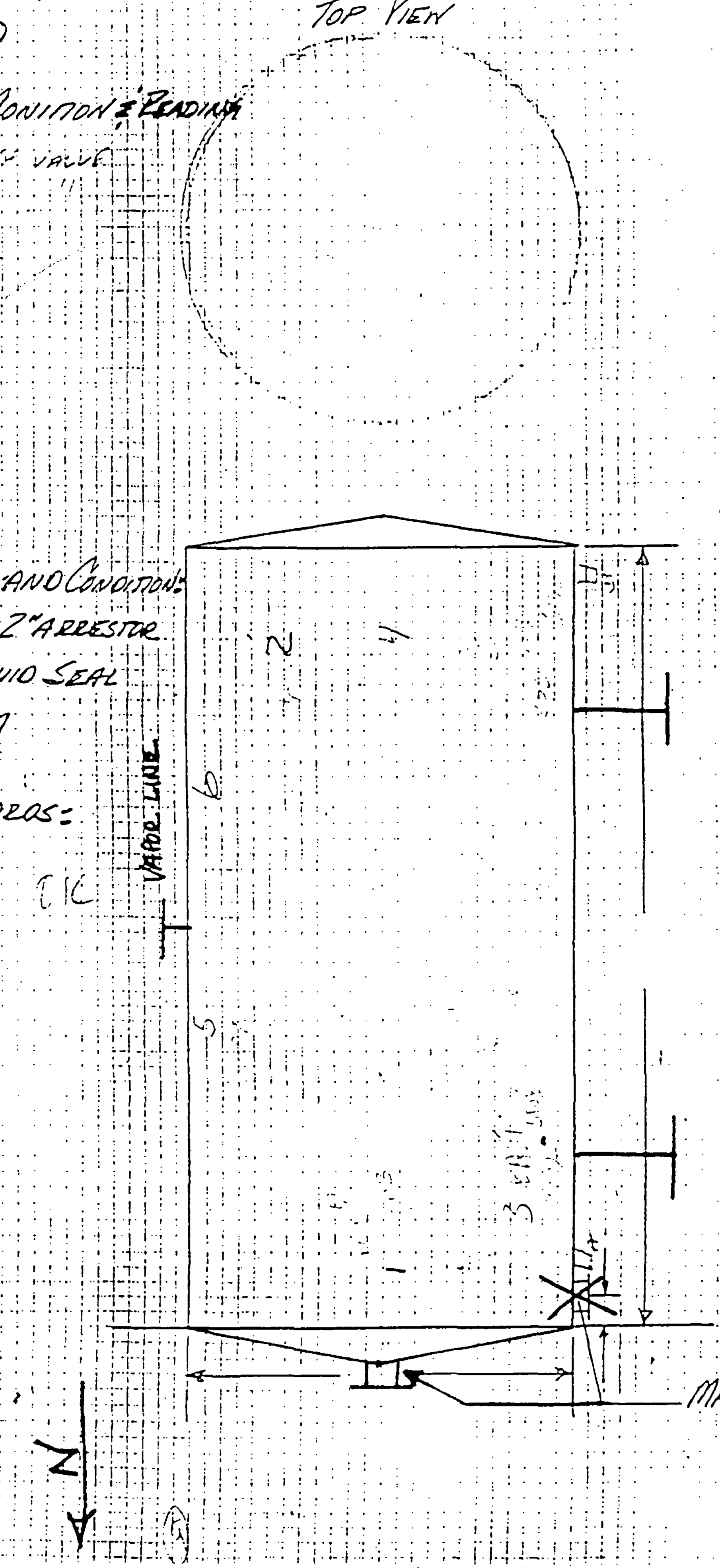
BREATHER AND 2" ARRESTOR

GAUGE AND LIQUID SEAL

LEVEL ALARM

DESIGN STANDARDS:

TANK EXTERIOR: OK



MANHEAD DIAM:

TANK: #1 STILL

INSPECTOR: JOHN SPUDVILLE

DATE: 6-15-87

MINIMUM WALL:

BOTTOM STR SIDE .222

'NT	HEIGHT ABOVE STR. SIDE	READING
	WEST SIDE	.303
	WEST SIDE	.306
3	EAST SIDE	.302
	EAST SIDE	.303
	TOP NORTH	.301
	TOP SOUTH	.306

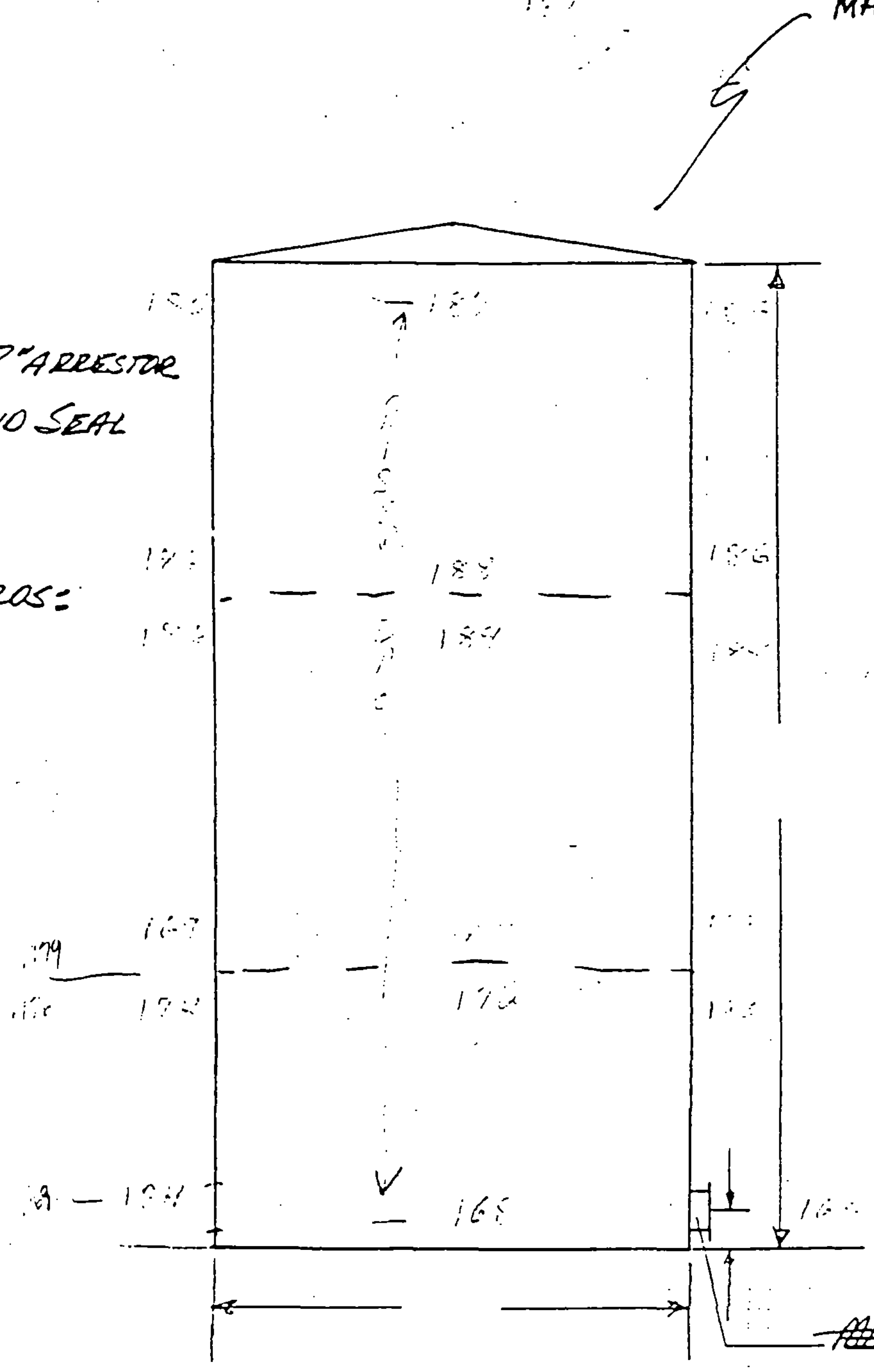
(10)

9-18-86

NK IDENT:

ATION:

LES:



FETY CONTROLS:
BREATHER AND 2" ARRESTOR
GAUGE AND LIQUID SEAL
LEVEL ALARM

ESIGN STANDARDS:

(11)

NK IDENT: #1 STILL

CATION: NORTH SIDE OF BUILDING

JUNE 10, 1986

ZZLES AND CONDITION:
MOUNT 332
116 .189
PIPE WORK .176
.166

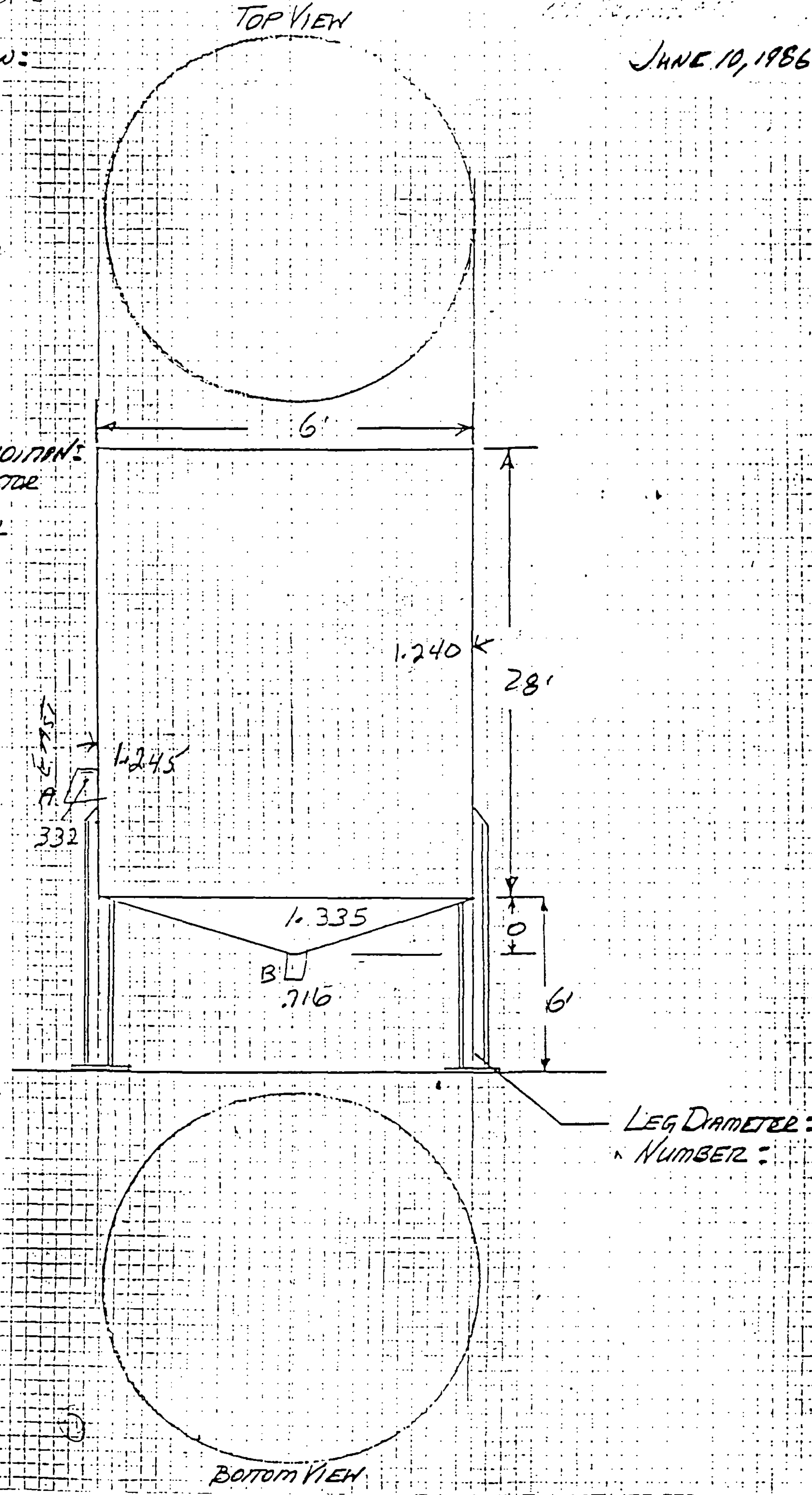
VAPOR LINE .168

ETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR

GAUGE AND LIQUID SEAL
LEVEL ALARM

SIGN STANDARDS:

NK EXTERIOR:



TANK PROFILE

?NK IDENT: #2 STILL

?CATION: NORTH SIDE

DATE: 7-15-86

JUNE 10, 1986

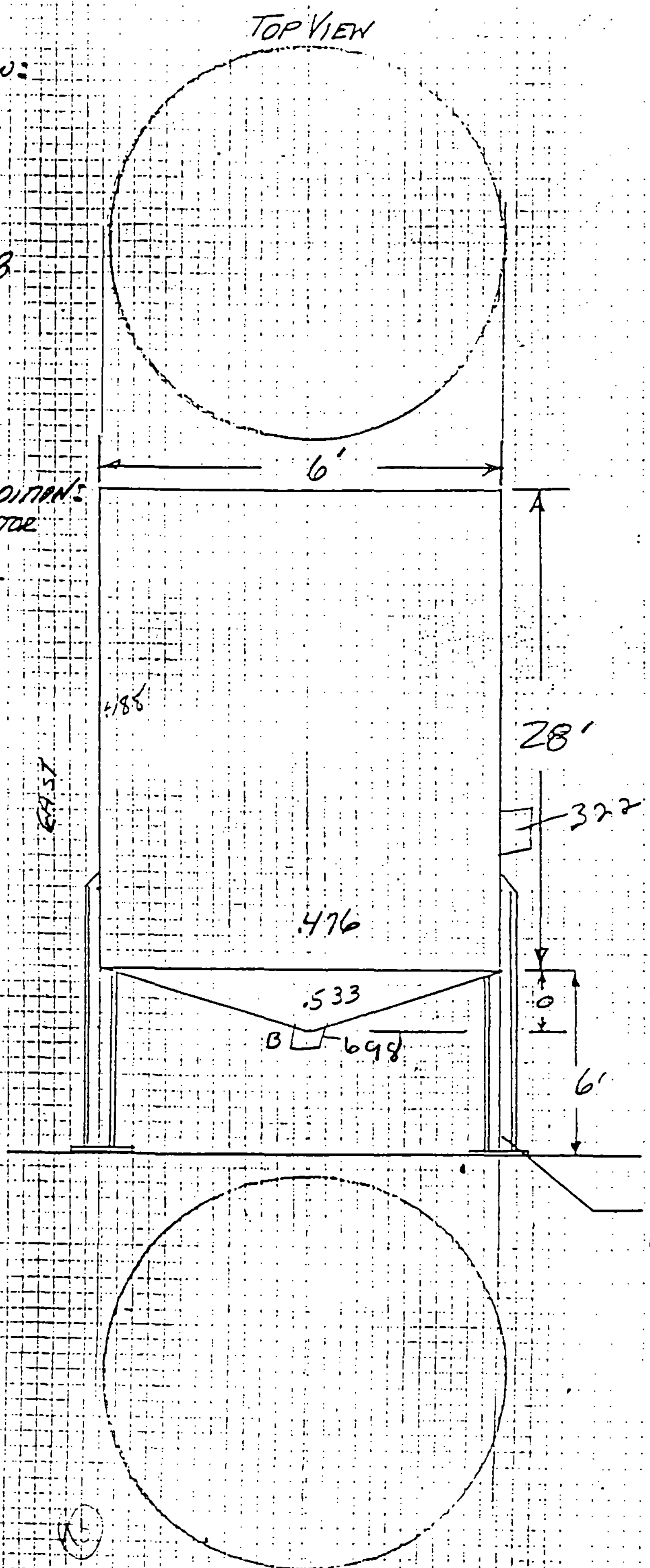
?ZZLES AND CONDITION:
? 2 MOUNT 322
-698
PIPE WORK 192
187

VAPOR LINE .173

?ETY CONTROLS AND CONDITION:
?REATHER AND 2" ARRESTOR
?AUGE AND LIQUID SEAL
LEVEL ALARM

?SIGN STANDARDS:

?NK EXTERIOR:



LEG DIAMETER:
NUMBER:

TANK IDENT: #3 STILL   TANK PROFILE   DATE: 7-15-'86

LOCATION: NORTH SIDE

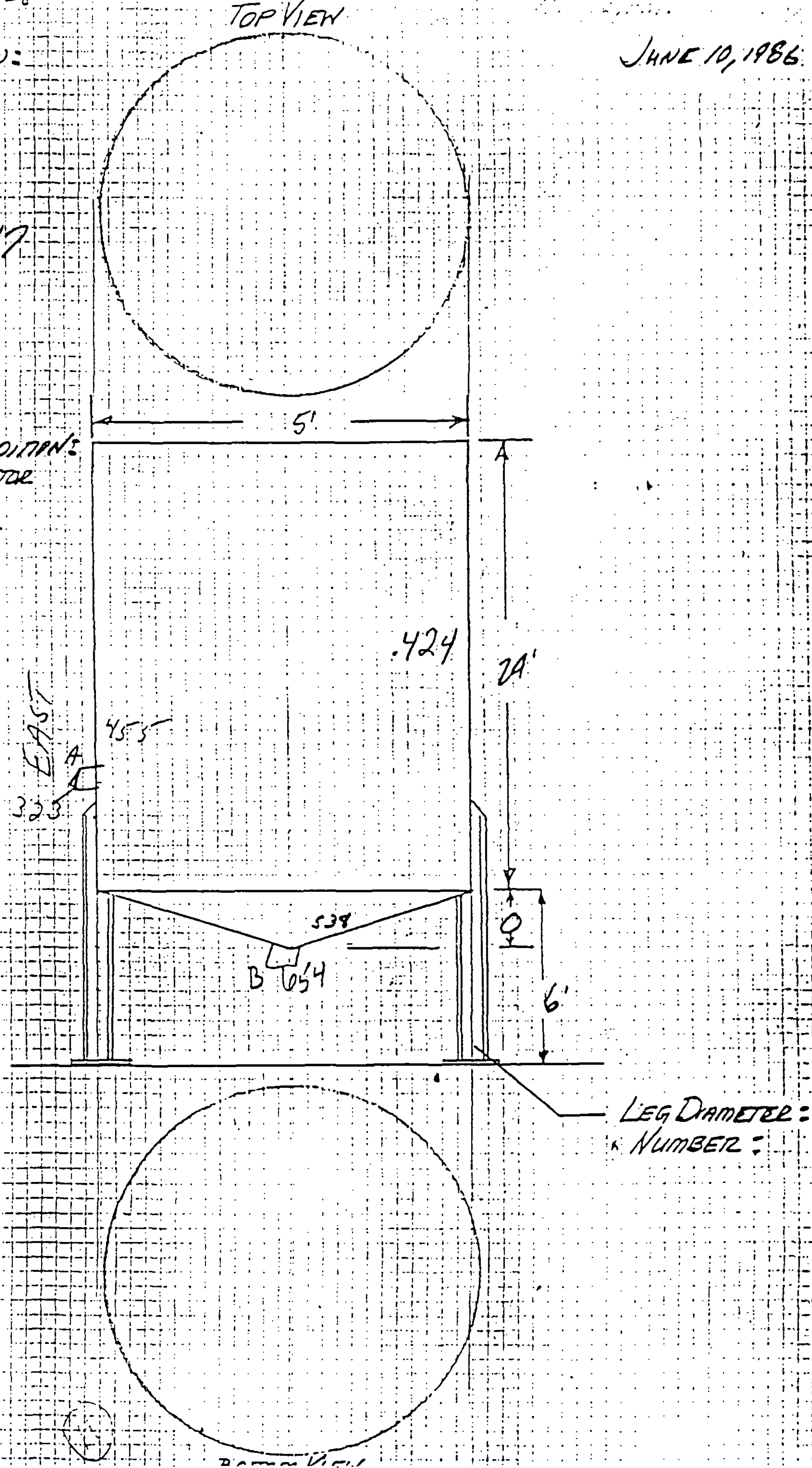
NOZZLES AND CONDITION:
MP MOUNT ,323
.654
PIPE WORK .192
VAPOR LINE .197

SAFETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR
GAUGE AND LIQUID SEAL
LEVEL ALARM

DESIGN STANDARDS:

TANK EXTERIOR:

JUNE 10, 1986



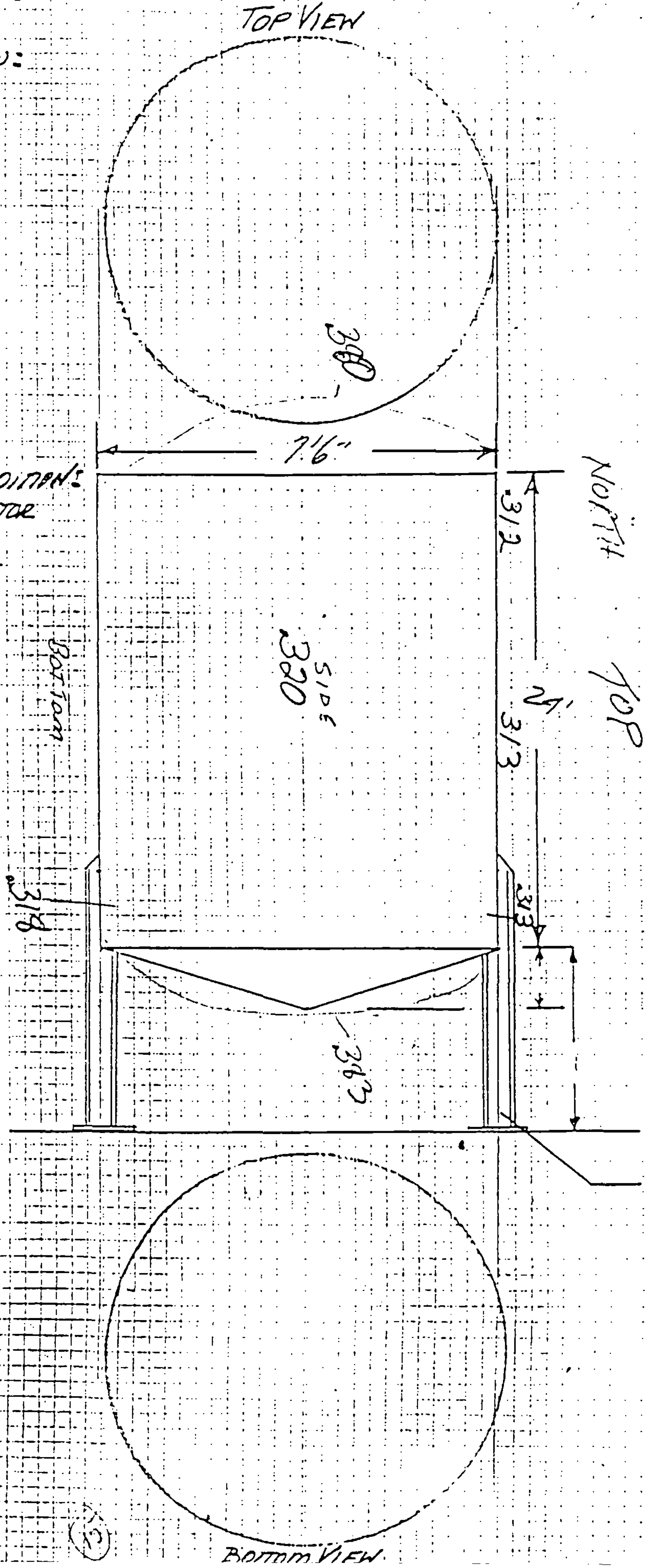
ANK IDENT = #7 STEEL

TANK PROFILE

JUNE 10, 1986

CATION = NORTHWEST SIDE OF BUILDING

ZZLES AND CONDITION:



ETY CONTROLS AND CONDITION:
BREATHER AND 2" ARRESTOR
GAUGE AND LIQUID SEAL
LEVEL ALARM

SIGN STANDARDS:

NK EXTERIOR:

LEG DIAMETER:
NUMBER:

8/7/87

RCRA TANK CONTENTS

1A & 1B: Methylene Chloride, 1,1,1 Trichloroethane, Trichloroethylene, Perchloroethylene — with oils

1002: Methanol, Isopropyl Alcohol & Butanol

116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126:

- Acetone
- Methanol
- Methyl Ethyl Ketone
- Isopropyl Alcohol
- Toluene
- Hexane
- Methyl Isobutyl Ketone
- Butyl Acetate
- Xylene
- Mineral Spirits
- Butyl Cellosolve
- Butanol
- Ethyl Acetate

— with oils, paint pigments & resins:

- Alkyd
- Urethane
- Epoxy
- Polyester
- Hydrocarbon

210, 211, 212, 201, 202, 203, 204, 205, 206:
All of the above in various ratios
Chlorinated not over 20% of total concentration.
All of the above in various ratios

Stills #1, 2, 3 & 7:
All of the above

#20: All of the above

Receivers: All of the above - no oils, resins or pigments

Still Wall Thickness:

Unit	Calculated Minimum Wall Thickness [1]	Constructed Thickness and Date	Present Thickness Reading 10-86 All Readings at ± Above Bottom Seam
#1 Still	.310 @ Bottom Seam	1.25 1945	1.240 @ + 12'
#1 Receiver	.025 @ Bottom Seam	.250 1983	.249 @ +1'
#2 Still	.310 @ Bottom Seam	.5 1945	.476 @ +1'
#2 Receiver	.025 @ Bottom Seam	.250 1983	.242 @ +1'
#3 Still	.245 @ Bottom Seam	.5 1945	.424 @ + 12'
#3 Receiver	.025 @ Bottom Seam	.250 1983	.242 @ + 1'
#7 Still	.222 @ Bottom Seam	.3125 1980	.312 @ + 7'6"
#7 Column	.065 @ Bottom Seam	.250 1979	.250 @ + 33'
#7 Receiver	.110 @ Bottom Seam	.500 1970	.480 @ + 1'

1 Refer to Wall Thickness Calculations Pages 10-11

DEC 1 9 1986

RCRA TANKS

RECLAIM: Location D

#1 Still	- 5500 Gals.	Vert	on	Legs
#1 Receiver	- 1100 Gals.	"	"	"
#2 Still	- 5500 Gals.	"	"	"
#2 Receiver	- 1100 Gals.	"	"	"
#3 Still	- 3500 Gals.	"	"	"
#3 Receiver	- 1100 Gals.	"	"	"
#7 Still	- 5500 Gals.	Horz	on	Saddles
#7 Column	- 52 cu. ft.	Vert	on	Skirt

RECLAIM CRUDE: Location B

#1A	- 2750	Gals.	Vert	on	Legs
#1B	- "	"	"	"	"
#116	- 10,800	Gals.	"	"	"
#117	- "	"	"	"	"
#118	- "	"	"	"	"
#119	- "	"	"	"	"
#120	- 6000	Gals.	"	"	"
#121	- 10,500	Gals.	"	"	"
#122	- "	"	"	"	"
#123	- 19,500	Gals.	Vert	Flat	Bottom
#124	- "	"	"	"	"
#125	- "	"	"	"	"
#126	- "	"	"	"	"
#1002	- 11,000	Gals.	"	"	"

DRUM PROCESSING: Location A

#20 - 1000 Gals. Vert on Legs

INJECTANT: Location C

#202	- 18,000	Gals.	Vert	Flat	Bottom
#203	- 16,000	Gals.	"	"	"
#204	- 17,000	Gals.	"	"	"
#205	- 18,000	Gals.	"	"	"
#206	- 17,000	Gals.	"	"	"
#210	- 23,000	Gals.	"	"	"
#211	- "	"	"	"	"
#212	- 24,000	Gals.	"	"	"

D-2a Description of Tanks (Refer to Individual Tank Profile Drawings)

TANK IDENT	1987 PRESENT SHELL THICKNESS (IN. @ ELEV)	WORKING CAPACITY (GALLONS)	DIAMETER (FEET)	HEIGHT (FEET)
Location A				
#20	.220 DISH .243 WALL	1000	5.5	5.5
Location B				
#1A	.5625 DISH .444 WALL	2750	6.5	10
#1B	.5625 DISH .423 WALL	2750	6.5	10
#116	.285 DISH .238 WALL	10,800	12	12
#117	.313 DISH .226 WALL	10,800	12	12
#118	.314 DISH .230 WALL	10,800	12	12
#119	.311 DISH .242 WALL	10,800	12	12
#120	.305 DISH .247 WALL	6000	9	12
#121	.307 DISH .238 WALL	10,500	10	18
#122	.308 DISH .248 WALL	10,500	10	18
#123	.242 TO 6' .242 ABOVE 6'	19,500	10	33
#124	.245 TO 6' .240 ABOVE 6'	19,500	10	33
#125	.241 TO 6' .240 ABOVE 6'	19,500	10	33
#126	.240 TO 6' .232 ABOVE 6'	19,500	10	33
#1002	.162 TO 6' .175 ABOVE 6'	11,000	10.5	18

JUL. 7 1987

(con't)

TANK IDENT	1987 METAL THICKNESS AT BASE	1987 METAL THICKNESS ABOVE 6'	MINIMUM WALL THICKNESS AT BASE	MINIMUM WALL THICKNESS ABOVE 6'
Location A				
#20	.220	.243	.018	NA
Location B				
#1A	.5625	.444	.040	NA
#1B	.5625	.423	.040	NA
#116	.285	.238	.093	NA
#117	.313	.226	.093	NA
#118	.314	.230	.093	NA
#119	.311	.242	.093	NA
#120	.305	.247	.070	NA
#121	.307	.238	.120	NA
#122	.308	.248	.120	NA
#123	.242	.242	.143	NA
#124	.245	.240	.143	NA
#125	.241	.240	.143	NA
#126	.240	.232	.143	NA
#1002	.159	.166	.063	NA
Location C				
#202	.241	.170	.130	.102
3	.221	.148	.120	.093

JUL 7 1987

TANK IDENT	AGE YEARS	ORIGINAL THICKNESS INCHES @ ELEVATION	PAST USAGE	PRESENT THICKNESS INCHES AT ELEVATION	AVERAGE THICKNESS PER YEAR LOST
Location A					
#20	21	.250 DISH	MIXING	.220 DISH	.0014
		.250 SHELL	VESSEL	.243 WALL	.004
Location B			SOLVENT		
#1A	16	.5625 DISH	SOLVENT	.5625 DISH	NIL
		.500 WALLS	STORAGE	.444 WALL	.0039
#1B	16	"	"	.5625 DISH	NIL
				.423 WALL	.005
#116	14	.3125 DISH	OIL	.285 DISH	.0023
		.250 WALLS	BLENDING	.238 WALL	.0008
#117	14	"	"	.313 DISH	NIL
				.226 WALL	.0017
#118	14	"	"	.314 DISH	NIL
				.230 WALL	.0015
#119	14	"	"	.311 DISH	.0001
				.242 WALL	.0005
#120	6	.3125 DISH	NEW	.305 DISH	.0021
		.250 WALLS		.247 WALL	.0005
#121	6	"	"	.307 DISH	.0025
				.238 WALL	.0040
#122	6	"	"	.308 DISH	.0007
				.248 WALL	.0003
#123	19	.250 WALLS	FUEL OIL	.242 TO 6'	.0003
			STORAGE	.242 ABOVE 6'	.0004
#124	19	"	"	.245 TO 6'	.0003
				.240 ABOVE 6'	.0005
#125	19	"	"	.241 TO 6'	.0005
				.240 ABOVE 6'	.0006
#126	19	"	"	.240 TO 6'	.0005
				.232 ABOVE 6'	.0009
#1002	10	.187 WALLS	SOLVENT	.162 TO 6'	.0025
			STORAGE	.175 ABOVE 6'	.0012
Location C					
#202	15	.250 TO 6'	FUEL OIL	.241 TO 6'	.0006
		.187 ABOVE 6'	STORAGE	.170 ABOVE 6'	.0012

JUL 7 1987
D-32

Discription of Stills: 320 IAC 4.1-34-7

Specifications: Refer to Drawing #1 Still S2 thru 6 of 6

#1 Still - 5500 gallons carbon steel 1.250" shell and 1.375" heads ASME designed and fabricated rated at 360 PSIG ambient 6' diameter x 28' straight side N/B #5792 Built 1945
Foundation - Fabricated on 4-6" I-beam legs, on a 12" thick concrete reinforced base.
Seams - Welded

#1 Heat exchanger - 31 sq.ft. carbon steel double walled schedule 40 pipe 80 lin ft. pipe rating 2000 Psi outer wall .216 inner wall .154 Bundle Demensions: 18" wide x 18" high x 24' long Built 1981
Foundation - Fabricated on 2-3" pipe supports and anchored into a 12" thick concrete reinforced base.
Seams - Pipe seams welded, connections threaded and bolted flanges.

#1 Condenser - 200 sq.ft. 304s.s. tubes, heads and carbon steel shell ASME designed and fabricated Rated 50 PSIG @ 750°F 12" diameter x 16' long Built 1970
Structural support - Attached to #1 Still
Seams - Welded and heads bolted

#1 Receiver - 1100 gallons carbon steel ¼" shell and heads API 650 designed and fabricated atmospheric storage tank 5' diameter x 8' straight side Built 1983
Foundation - Fabricated on 4-4" I-beam legs, fireproofed and anchored on a 12" concrete reinforced base.
Seams - Welded

1 PC_1 - Sarco 1½" steam regulator #25P with pilot working range 20 to 100 psig and 0 to 2000#/hr

1 P_1 - Recirculation Pump - 2" Krogh Model 550H 7½ H.P. 50 GPM @ 50psi equipped with double mechanical seal

1 P_2 - Product Pump - LaBour Size 10DHL 1½ H.P. 30 GPM @ 60' TDH equipped with single mechanical seal

1 P_3 - Residue Pump - Worthington Model D-1011 3 x 1½ x 10 H.P. 100 GPM @ 60psi

1 T_1 - #1 Still Pot Temperature Type J Thermocouple to Control Panel Readout

DEC 19 1986

1 T_2 - #1 Still Vapor Temperature Type J Thermocouple to Control Panel Readout

1 T_3 - #1 Condenser Cooling Water Temperature In Type J Thermocouple to Control Panel Readout

1 T_4 - #1 Condenser Cooling Water Temperature Out Type J Thermocouple to Control Panel Readout

1 RD_1-2" - Continental Rupture Disc rated at 20psi @ 350°F [1]

1 PI_1 - Pressure Indicator to Control Panel and Foxboro 43 AP Vacuum Controller w/3-15# output to Control Valve IVC1

1 VC_1 - Control Valve Foxboro M/V/S Stabilflo S.S.

1 F_1 - Proof of Flow Switch to Control Panel Indicator

1 F_2 - EEP 2" - 805s Sight Flow Indicators

1 L_1 - #1 Receiver Visual Level Indicator Model ACS

1 FA_1 - Varec Flame Arrestor 2" - 50 Series [2]

[1] Refer to Venting Capacities Page 18

[2] Refer to Venting Capacities Pages 12-17

 DEC 19 1986

Specifications:

#2 Still	- 5500 Gallons Carbon Steel ½" shell and heads ASME Designed and Fabricated Rated at 270 PSIG ambient 6' diameter x 28' straight side N/B #1029 Built 1945 Foundation - Fabricated on 4-6" I Beam legs, fireproofed and anchored on a 12" thick concrete reinforced base. Seams - Welded
#2 Heat Exchanger	- 31 sq.ft. Carbon Steel Double walled schedule 40 pipe. 80 Lin. ft Pipe Rating 2000psi Outer wall .216 Inner wall .154 Bundle Demensions 18" wide x 18" High x 24' long Built 1981 Foundation - Fabricated on 2-3" pipe supports and anchored into a 12" thick concrete reinforced base. Seams - Pipe seams welded, connections threaded and bolted flanges.
#2 Condenser	- 200 sq.ft. 304 s.s. Tubes, Heads and Carbon Steel Shell ASME designed and fabricated Rated 50 PSIG @ 750°F 12" diameter x 16' long Built 1970 Structural Support - Attached to #2 Still Seams - Welded and Heads Bolted
#1 Receiver	- 1100 Gallons Carbon Steel ¼" Shell and Heads. API 650 Designed and Fabricated, Atmospheric Storage Tank 5' diameter x 8' straight side Build 1983 Foundation - Fabricated on 4-4" I-Beam Legs, fireproofed and anchored on a 12" thick concrete reinforced base. Seams - Welded
2 PC_1	- Sarco 1½" steam regulator #25P with pilot working range 20 to 100 PSIG and 0 to 2000#/hr.
2 P_1	- Recirculation Pump - 2" Krogh Model 550H 7½ H.P. 50 GPM @ 50 psi equipped with double mechanical seal.
2 P_2	- Product Pump - LaBour Size 10 DHL 1½ H.P. 30 GPM @ 60' TDH equipped with single mechanical seal.
1 P_3	- Same Pump mentioned in specifications for #1 Still
2 T_1	- #2 Still Pot Temperature Type J Thermocouple to Control Panel Readout
2 T_2	- #2 Still Vapor Temperature Type J Thermocouple to Control Panel Readout

DEC 1 9 1986

2 T_3	- 2 Condenser Cooling Water Temperature In Type J Thermocouple to Control Panel Readout
2 T_4	- #2 Condenser Cooling Water Temperature Out Type J Thermocouple to Control Panel Readout
2 RD_1-2"	- Continental Rupture Disc rated at 20psi @ 350°F [1]
2 PI_1	- Pressure indicator to control panel and Foxboro 43AP Vacuum Controller W/3-15# output to Control Valve 2VC1
2 VC_1	- Control Valve Foxboro M/V/S is Stabilflo s.s
2 F_1	- Proof of Flow Switch to Control Panel Indicator
2 F_2	- EEP 2"-805s Sight Flow Indicators
2 L_1	- #2 Receiver Visual Level Indicator Model ACS
2 FA_1	- Varec Flame Arrestor 2" - 50 series [2]

1 Refer to Venting Capacities Page 18

2 Refer to Venting Capacities Pages 12-17

DEC 1 9 1986

Specifications:

#3 Still	- 3500 Gallons Carbon Steel ½" shell and heads ASME designed and fabricated Rated at 359 PSIG ambient 5' diameter x 24' straight side N/B# 1028 Built 1945 Foundation - Fabricated on 4-6" I-Beam legs, fire-proofed and anchored on a 12" thick concrete reinforced base. Seams - Welded
#3 Heat Exchanger	- 16 sq.ft. Carbon Steel Double Walled Schedule 40 Pipe. 40 lin.ft. Pipe rating 2000 psi Outer wall .216 Inner wall .154 Bundle deminsions 18" wide x 18" high x 24' long Built 1981 Foundation - Fabricated on 2-3" pipe supports and anchored into a 12" thick concrete reinforced base. Seams - Pipe seams welded connections threaded and bolted flanges.
#3 Condenser	- 200 sq.ft. 304 s.s. Tubes, Heads and Carbon Steel Shell ASME designed and fabricated Rated 50 PSIG @ 750°F 12" diameter x 16' long Built 1970 Structural Support - attached to #3 Still Seams - Welded and Heads bolted
#3 Receiver	- 1100 Gallons Carbon Steel ¼" Shell and Heads API 650 designed and fabricated, Atmospheric Storage Tank 5'diameter x 8' straight side Built 1983 Foundation - Fabricated on 4-4" I-Beam legs, fire-proofed and anchored on a 12" thick concrete reinforced base. Seams - Welded
3 PC_1	- Sarco 1½" steam regulated #25P with Pilot Working Range 20 to 100 PSIG and 0 to 2000#/hr.
3 P_1	- Recirculation Pump - 2" Krogh Model 550H 7½ H.P. 50 GPM @ 50 psi equipped with Double Mechanical Seal
3 P_2	- Product Pump - LaBour Size 10DHL 1½ H.P. 30 GPM @ 60' TDH equipped with Single Mechanical Seal.
1 P_3	- Same pump mentioned in specifications for #1 Still
3 T_1	- #3 Still Pot Temperature Type J Thermocouple to Control Panel Readout
3 T_2	- #3 Still Vapor Temperature Type J Thermocouple to Control Panel Readout
3 T_3	- #3 Condenser Cooling Water Temperature in Type J Thermocouple to Control Panel Readout

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3 T_4	- #3 Condenser Cooling Water Temperature Out Type J Thermocouple to Control Panal Readout
3 RD-2"	- Continental Rupture Disc Rated at 20psi @ 350°F [1]
3 PI_1	- Pressure indicator to Control Panel and Foxboro 43AP Vacuum Controller W/3-15# output to Control Valve $3VC_1$
3 VC_1	- Control Valve Foxboro M/V/S Stabilblo s.s.
3 F_1	- Proof of Flow Switch to Control Panel Indicator
3 F_2	- EEP 2"-805s Sight Flow Indicators
3 L_1	- #3 Receiver Visual Level Indicator Model ACS
3 FA_1	- Varec Flame Arrestor 2" - 50 series [2]

1 Refer to Venting Capacities Page 18

2 Refer to Venting Capacities Pages 12-17

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Specifications:

#7 Still - 5500 Gallons, 304s.s. (SA-240) 5/16 shell and 3/8 heads ASME designed and fabricated Rated at full vacuum or 25 PSIG @ 350°F 7'6" diameter x 24' straight side N/B #7715 Built 1980
Steam Temp-Plate, 60 sq.ft., 304 s.s. (SA-240) Coil - 14 G.A. and Coil Plate - 5/16 ASME designed and fabricated Rated at 150 PSIG @ 365°F
Foundation - 2-24" wide concrete reinforced saddle support walls 48" high. Constructed on a 12" thick concrete reinforced base.
Seams - Welded

#7 Column - 304s.s. ¼ shell and head ASME designed and fabricated Rated at full vacuum or 25 PSIG at 300°F 18" I.D. x 33' straight side N/B #1164 Built 1979
2- packed section 15' long (26 cu.ft.) with #25 intalok metal rings 304s.s.
Foundation - column is constructed with a ¼" thick x 10' long skirt. the unit is anchored to a concrete reinforced support 72" wide x 72" long x 48" high on a 12" thick concrete reinforced base
Seams - Welded

#7 Condenser - 280 sq.ft. 316s.s. tubes, heads and carbon steel shell ASME designed and fabricated Rated - tubes 75 psig @ 350°F Shell 75 psig @ 350°F
16" diameter x 12' long N/B# 12390 Built 1958
Foundation - Constructed on a steel support structure 48" x 48" x 24'6" high and is anchored to 12" thick concrete reinforced base.
Seams - Welded and heads bolted

#7 Receiver - 400 gallons 316s.s. ½ shell and heads ASME designed and fabricated Rated at 150 PSIG @ 300°F 48" diameter x 48" straight side Built 1970
Foundation - Fabricated on 4-4" pipe legs, fireproofed and anchored on a 12" thick concrete reinforced base
Seams - Welded

7 PC_1 - Sarco 1½" steam regulator #25P with pilot working range 20 to 100 PSIG and 0 to 2000 #/HR

7 T_1 - #7 still Pot Temperature Type J Thermocouple to Control Panel Readout

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7 T_2	-	#7 Still Vapor Temperature Type J Thermocouple to Control Panel Readout
7 T_3	-	#7 Column Head Temperature Type J Thermocouple to Control Panel Readout with recorder
7 T_4	-	#7 Condenser cooling water temperature in Control Panel Readout
7 T_5	-	#7 Condenser cooling water temperature out Control Panel Readout
7 RD_1 Thru 7 RD_3	-	Continental Rupture Disc rated at 20 psi @365°F and full vacuum [1]
7 DP_1 and 7 DP_2	-	#7 Column differential pressure to Control Panel Foxboro D/P cell with indicator 0 to 20" W.C.
7 F_1 and 7 F_2	-	Rotometer F/P 10A3500 Rate 200 gallons/hours
7 F_3	-	Proof of flow switch to Control Panel Indicator
7 P_1	-	Reflux Pump - ECO C10A Mechanical Seal 50 GMP @ 35 PSIG
7 L_1	-	#7 Receiver level indicator - Foxboro D/P cell with Control Panel Readout

[1] Refer to Venting Capacities Page 18

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Calculations for minimum wall thicknesses.

Based on API 650 A 4.1 A minimum allowable wall thickness was developed for each vessel.

$$t = \frac{2.6\ (D)\ (P+H-1)\ (G)}{SE} + C.A.$$

t= wall thickness in inches
D= nominal diameter of vessel in feet
P= Maximum internal pressure

$$(\text{Psi} \times 2.307\ \frac{\text{feet of water}}{\text{PSI}})$$

H= vessel height in feet
G= maximum specific gravity of liquid
SE=maximum allowable stress
SA-240 (304s.s.) = 16,200
A -283 (Carbon Steel) = 14,700
CA=corrosion allowance in inches

The corrosion allowance for each vessel was based on the minimum wall thickness required to secure the material at the maximum internal pressure. Then using the corrosion allowance, a minimum wall thickness was calculated by using a safety factor or 150%.

<u>#1</u> <u>Still</u> - Maximum Internal Pressure - 20 Psi @ 350°F
Maximum Specific Gravity - 1.6

With C.A. = 0 $t= \frac{2.6\ (6)\ (46.14 + 28 -1)\ (1.6)}{14,700}$

t=.124

Safety Factor: .124 x 150% = .186
With C.A. = .186 t=.310

#2 Still - Maximum Internal Pressure - 20 Psi @ 350°F
Maximum Specific Gravity - 1.6

With C.A. = 0 $t= \frac{2.6(6)\ (46.14+28-1)(1.6)}{14,700}$

t=.124

Safety Factor: .144 x 150% = .186
With C.A. = .186 t=.310

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#3 Still - Maximum Internal Pressure - 20psi @ 350°F
Maximum Specific Gravity - 1.6

With C.A. = 0 $$t=\frac{2.6(5)(46.14+24-1)(1.6)}{14,700}$$

t=.098

Safety Factor: .098 x 150% = .147
With C.A. = .147 t = .245

#7 Still - Maximum Internal Pressure - 20 Psi @ 365°F
Maximum Specific Gravity - 1.4

With C.A. = 0 $$t=\frac{2.6(7.5)(46.14+7.5-1)(1.4)}{16,200}$$

t=.089

Safety Factor: .089 x 150% = .133
With C.A. = .133 t = .222

#7 Column - Maximum Internal Pressure - 20 Psi @ 365°F
Maximum Specific Gravity - 1.4

With C.A. = 0 $$t=\frac{2.6(1.5)(46.14+33-1)(1.4)}{16,200}$$

t=.026

Safety Factor: .026 x 150% = .039
With C.A. = .039 t = .065

#7 Receiver - Maximum Internal Pressure - 20 Psi @ 365°F
Maximum Specific Gravity - 1.4

With C.A. = 0 $$t=\frac{2.6(4)(46.14+4-1)(1.4)}{16,200}$$

t=.044

Safety Factor: .044 x 150% = .066
With C.A. = .066 t = .110

#1, #2 & #3 Receivers - Maximum Internal Pressure - Atmospheric
Maximum Specific Gravity - 1.6

With C.A. = 0 $$t=\frac{2.6(5)(8-1)(1.6)}{14,700}$$

t=.010

Safety Factor: .010 x 150% = .015
With C.A. = .015 t=.025

DEC 19 1986

D-2a Description of Tanks (Refer to Individual Tank Profile Drawings) (con't)

TANK IDENT	MATERIAL OF CONSTRUCTION	PRESSURE CONTROLS	FOUNDATION	SEAMS
Location A				
#20	A 240 316 S.S.	NONE	6" CONC	WELDED
Location B				
#1A	A 283C C.S.	STORAGE TANKS OPERATE AT ± .5 oz BY USING POSITIVE AND NEGATIVE BREATHING VALVES	12" CONC	WELDED
#1B	"		"	"
#116	"		"	"
#117	"		"	"
#118	"		"	"
#119	"		"	"
#120	"		"	"
#121	"		"	"
#122	"		"	"
#123	"		"	"
#124	"		"	"
#125	"		"	"
#126	"		"	"
#1002	"		CLAY BASE WITH 6" TO 8" GRAVEL #73	"

JUL 7 1987

D-4B

Still Condition Assessment: 320 IAC 4.1-49-46

Based on past experience and recorded tank corrosion and erosion loses (Refer to Discription of Stills) the Condition Assessment of each still unit is performed annually and recorded on the Unit Profile (Refer to page 48).
The procedure is as follows:

A.) Wall thickness readings are taken as described below.

B.) Nozzle conditions are inspected and recorded.

C.) Safety controls are inspected and the conditions recorded.

D.) The unit exterior is inspected and the condition is recorded.

E.) Refer to Unit Profile Checklist page 47.

The Unit Profile forms are then analyzed by the Maintenance Supervisor for deficiences and or signs of accelerate corrosion or erosion. The deficiences are corrected thru maintenance action as described in Inspections. If accellerated corrosion or erosion has caused the tank wall thickness to be at the minimum wall thickness an interior inspection will be conducted.

The equipment used to measure wall thickness was a Panametrics Ultrasonic Thickness Gauge (Model 5226) (Refer to pages 49-50. Each unit was measured by first scraping the painted surface to the bare metal. A thin film of conductivity grease was applied to the area and the measurement was taken. The equipment was recalibrated for each unit from a standard block. The number of points measured for each unit was based on the variation of the readings. For the units a minimum of three readings were taken on the bottom dish. One about 12" from the bottom nozzle, one halfway to the sidewall and one 12" from the sidewall. The shells were measured a minimum of six locations. Two 6" up the sidewall, one on either side of the first seam and one on either side of the second seam. If discrepencies developed more readings were taken. The recorded metal thicknesses were based on the minimum readings (Refer to Decription of Stills - Present Shell Thickness).

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Unit Profile Checklist September 1986

A.) Unit Nozzles:

1.) Inspect the nozzle and surrounding areas for signs of leaking.

2.) Inspect the nozzle fitting for signs of corrosion.

3.) Make a thickness reading of the nozzle and record.

B.) Safety Controls:

1.) Internal inspection of the flame arrestor. Check plates for spacing and signs of corrosion. Record condition.

2.) Check the sealant level of the unit level gauge. Inspect free movement of gauge and external for corrosion. Record condition.

3.) Check for security and signs of corrosion the safety controls and monitoring devices. (Thermocouples, impulse lines and pressure gauges)

4.) Inspect rupture disc assemblies by removing the rupture disc and inspecting the nozzle for blockage and the disc for cracks.

5.) Inspect the flow control devices for proper performance.

C.) Measure and record the unit wall thickness readings.

D.) Unit Exterior:

1.) Inspect the exterior of the unit and inter-connecting piping for cracks, seam leaks and corrosion.

2.) Check the vessel legs, supports and foundations for signs of fatigue, cracks and fire proofing.

3.) Inspect surrounding area and interconnecting piping for signs of leaking.

4.) Check general condition of exterior paint covering and insulation.

5.) Record condition.

'NIT IDENT:

OCATION:

'...PLES AND CONDITIONS:
(PROFILE FOR LOCATION)

UNIT PROFILE

TOP VIEW

FETY CONTROLS AND CONDITIONS:

FLAME ARRESTOR:

UNIT LEVEL GAUGE:

SECURITY:

RUPTURE DISC:

FLOW CONTROL DEVICES:

'T THICKNESS READINGS:
(PROFILE OF UNIT TO
APPROXIMATE LOCATION)

'IT EXTERIOR:

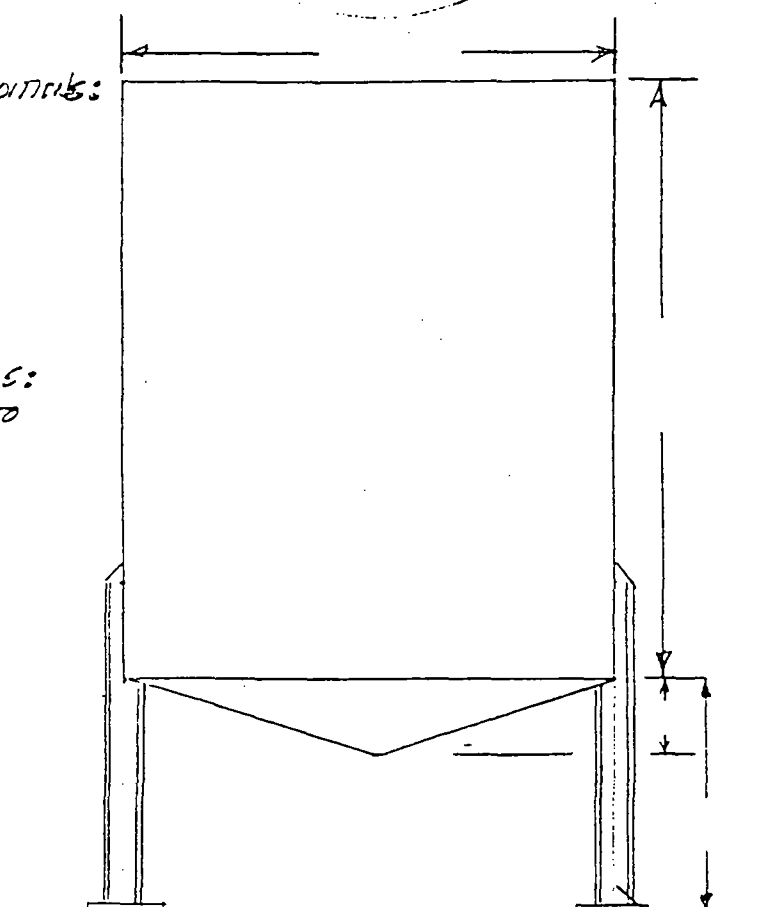
UNIT:

NTERCONNECTING PIPING:

SUPPORTS & FOUNDATION:

URROUNDING AREA:

PAINT & INSULATION:



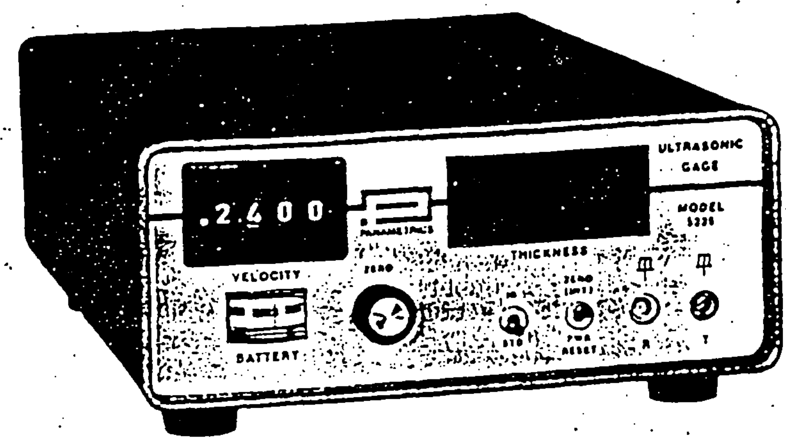
LEG DIAMETER:
NUMBER:

DEC 19 1986

June 10 1986

PANAMETRICS

ULTRASONIC THICKNESS GAGE MODEL 5226



MODEL 5226

- Nondestructive measurement from one side of a wide variety of engineering materials.
- Makes accurate readings on rough and corroded metal parts and on hot castings.
- A single repairable transducer covers entire thickness and temperature range.

  Electronic Zero eliminates the necessity for test blocks and speeds calibration.
- LCD display can be read in direct sunlight and is backlighted for low ambient light conditions.
- Display has switchable Blank or Hold for last reading.
- Oscilloscope outputs are standard.
- Continuous Material Velocity Compensation (MVC) Control allows accurate measurement on entire range of materials.
- Lightweight for easy portability.
- One year warranty on parts and labor.

DESCRIPTION

The Model 5226 is an Ultrasonic Thickness Gage designed to provide improved measurement capability in difficult applications. It uses a special Dual Transducer to make measurements on most engineering materials over a wide range of thickness and temperature.

APPLICATIONS

The Model 5226 Thickness Gage is designed to make reliable measurements where normal single element pulse-echo gages don't work because of surface conditions, temperatures, or part geometry.

Using the 5226, pipes, pressure vessels, and storage tanks can be monitored for thinning due to corrosion or erosion. It is useful for the pipeline, refinery, or processing plant where many different engineering materials must be measured over a large range of thickness and temperature.

The 5226 can also be used to measure the wall thickness of other products. It provides a dependable way to make manual measurements before the parts cool completely.

A single transducer is used over the entire thickness and temperature range of the gage and, together with the internal electronic zero, eliminates the need for a test block to verify correct zero setting.

The 5226 measures thickness using a nondestructive pulse-echo technique similar to sonar. A high-frequency sound pulse is generated by exciting the transducer with an electrical pulse. This sound pulse travels, through the material, reflects off the back surface, and returns back through the part to the transducer. The gage measures the transit time of the sound pulse, compensates for the sound velocity of the material being tested, and displays a digital readout of the thickness. Once the gage is calibrated, the operator merely places the transducer in contact with the part, using an appropriate couplant, and reads the thickness on the digital display.

Panametrics, Inc. • 221 Crescent St. • Waltham, MA 02154
617-899-2719

Thickness Measurement Range	0.040 to 10.000 inches or 1.00 to 199.99 mm
Calibrated Accuracy	± 0.004 inches or ± 0.1 mm over measurement range
Resolution	0.001 inches or 0.01 mm or 0.1 mm
Velocity Calibration Range	0.0500 to 0.7999 in/μsec or cm/μsec
Zero Adjustment Range	± 1.3 μsec or ± 0.15 inches (± 3.9 mm in steel)
Display Type	4½ digit high contrast liquid crystal display with switchable backlight and fixed decimal point
Display Mode	Switchable HOLD/BLANK HOLD—Display holds the last reading. Decimal point blinks to indicate hold mode BLANK—Display blanks when no reading is being made
Transducer Type	Dual (pitch-catch) pulse echo
Test Mode	First echo measurement
Gage Operating Temperature Range	0° to 50°C
Transducer Operating Temperature Range	− 40°C to 500°C surface temperature (intermittent use)
Power Requirements	100, 115, or 230 VAC, 50-60 Hz, 5W max. (Charger/AC adaptor) 6VDC, 2.6 Amp-Hr
Battery Type	6V rechargeable solid gel battery
Battery Life	8 hours continuous operation (automatic shutoff extends battery life)
Battery Charging Time	16 hour maximum charging time (fully discharged battery)
Automatic Shutoff	Gage automatically shuts off power approximately 3 minutes after last reading
+ Sync Output	Positive t_r < 30 nsec; Z_{out} = 50Ω
Rcvr Monitor Output	± 0-2.4V from 50Ω source, no load
Marker Output	± 4V TTL logic pulse with main bang blank pulse superimposed
Size	2¾" × 6½" × 9½" (70mm × 165mm × 242mm)
Weight	4¼ lbs. including battery (1.9 kg)
Included Accessories	D762 Dual Transducer, 3.5 MHz Charger/AC Adapter (Model 5200) (specify 100, 115 or 230 VAC) 2215 Dual Cable Set, 6 ft. (1.83 m) 2203 Carrying Case Couplant B (glycerin) 2 oz. 2248 Instruction Manual 2217 Test Block — Steel (specify 0.200" or 5 mm) Reusable Shipping Container

All specifications are subject to change without notice.

DEC 19 1986

Printed in

Still Interior Inspection: 320 IAC 4.1-44-4b

If minimum tank wall thickness readings or any other exterior inspection should demand concern about the integrity of a unit an interior inspection of the suspect unit will be conducted. The procedure will be as follows:

A.) Immediately the suspect unit will be isolated from thru put operations.

B.) The suspect unit will be emptied as soon as practicable.

C.) As scheduled, the unit will be opened and a hazardous atmosphere entry will be conducted (Refer to pages 53 - 55). If solid material is present in the suspect unit it will be removed according to the procedure outlined on page 52 Discription of a Laborers Duties. During the interior inspection signs of cracking will be checked on the shell and floor of the tank.

D.) After the interior inspection, the condition of the storage tank will be analyzed by the Maintenance Supervisor and a decision on the soundness of the tank will be made.

DEC 19 1986

D-2b Tank Corrosion and Erosion

Based on API 650 A 4.1 a minimum allowable Shell thickness was developed for each storage tank.

$$t=\frac{(2.6)(D)(H-1)(G)}{(E)\ (21{,}000)} + C.A.$$

t = wall thickness in inches
D = nominal diameter of tank in feet
H = height in feet
G = specific gravity of liquid
E = joint efficenty = .7
C.A. = corrosion allowance in inches

The corrosion allowance for each tank was based on the minimum wall thickness required to secure the stored material with the maximim specific gravity shown in C-1b. (Waste in tanks) Then using the corrosion allowance, a minimum wall thickness was calculated by using a safety factor of 150%.

APPENDIX D

SITE SAFETY AND HEALTH PLAN FOR OPERATIONS CONDUCTED UNDER THE RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA)

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

AMERICAN CHEMICAL SERVICE, INC.

SITE SAFETY AND HEALTH PLAN

P.O. Box 260
Columbus, Ohio 43216
614-475-3792

CERTIFICATION of TRAINING

Managing Hazardous Waste Operations 29 CFR 1910.120 (e) (3)

* * *

The purpose of this memorandum is to certify that:

John J. Murphy, Vice President
American Chemical Service, Inc.

has received the specialized training required of on-site management and supervisors who are directly responsible for, or who supervise employees engaged in, hazardous waste operations as required by 29 CFR 1910.120 (e) (3). The course that Mr. Murphy participated in was held in Atlantic City, New Jersey, on June 9th, 1987. The course content included:

- thorough coverage of the standard.
- health and safety program requirements.
- training program requirements.
- spill containment program requirements.
- health hazard monitoring techniques.
- medical surveillance requirements.
- other, related, pertinent compliance information.

Certifying instructor:

Wm R Bunner

Wm R. Bunner, C.E.T.

TRAINING ASSOCIATES

american Chemical Service, Inc.
P.O. Box 190 · Griffith, Indiana 46319
(219) 924-4370 · Chicago Phone (312) 768-3400

Site Safety And Health Plan For Operations Conducted Under The Resource Conservation And Recovery Act Of 1976 (RCRA)

Developed: January 1987

Source: Occupational Safety and
Health Administration
29 CFR Part 1910

Contents:

SECTION A:

KEY PERSONNEL

A. Key Personnel:

This section addresses the requirement to name key personnel and alternates responsible for site safety and health and the appointment of a site safety and health officer.

Due to physical size of the RCRA operations at American Chemical Service, Inc. (ACS), there will be an appointment of only one site safety and health officer. At this time, the management of ACS appoints Thomas J. Murphy to the position of Site Safety and Health Officer.

The Site Safety and Health Officer will be responsible for implementation of all sections of this Site Safety and Health Plan. With the cooperation of the management of ACS, the officer will conduct inspections as necessary to determine the effectiveness of the plan and make alterations to correct deficiencies. Attached is a copy of the daily checklists conducted in the RCRA areas

June 10, 1986

Maintenance Inspection Procedure

A.) On all operating days between 7^{30} and 8^{30} AM the following hazardous waste areas are inspected by facility personnel:

1.) Location A - Drum Unloading Dock
2.) Location B - Reclaim Area
3.) Location C - Injectant Storage Area

B.) Each area has a Schedule to outline the inspection procedure and to identify the types of problems to look for during the inspection. Frequency determines how often an item is checked D (Daily) W (Weekly) M (Monthly). The frequency of inspection is based on past years of operating experience and previous Maintenance Logs.

C.) If a problem is observed during the inspection, a Maintenance Action Sheet is filled out listing the problem and location.

D.) After the inspection the Inspection Log is intialized and noted as follows:

OK - Area shows no apparent problems
NOK - Area has the problems as listed on the Maintenance Action Sheet.

E.) The Inspection Log and Maintenance Action Sheets are reviewed by the Maintenance Supervisior the same operating day. If maintenance action is required, an entry is made into the Maintenance Log.

F.) The Maintenance Log is used to schedule maintenance action.

G.) When the maintenance is performed and the problem is corrected the Maintenance Log is dated and the Maintenance Action Sheet is dated and initialed.

H.) All records reflecting maintenance in Locations A,B, or C must be kept for 3 years.

May 1986

Area Schedule

Location A - Drum Unloading Dock

Frequency	Item
	A.) Inspect 90 GPM Drum Unloading Pump:
	1.) Drum out hose:
D	a.) Check for loose connections
D	b.) Cracked or swelled hose sections
D	c.) Operation of the shut off valve
W	d.) Loose fittings on the drum out pipe
	2.) Drum out Filter:
D	a.) Check for leaking around top gasket
D	b.) Make sure cover bolts are in place
W	c.) Check for loose fittings on the inlet and outlet
	3.) Drum Out Pump
D	a.) Check packing for signs of leaking
D	b.) Check head gasket for signs of leaking
D	c.) Operation of the bleeder valve and signs of leaking
W	d.) Electrical connection to the motor
W	e.) Check for loose fitting on the suction and discharg piping
M	f.) Check the oil level in the gear box
	B.) Inspect the Container Containment Area:
D	1.) Check the base, containment burm, sump and foundation walls for cracks and erosion.
D	2.) Check the grating on the sump for broken welds or cracks.
W	3.) Check the condition of the trailer bump blocks and make sure they are not loose or detached.
W	4.) Check the stairway for loose or missing steps, hand rails, and structural members.
D	5.) Check surrounding area for signs of leaks or spills.
	C.) Inspect the Roof Structure:
M	1.) Check Structural Columns:
	a.) Make sure floor bolts are in place and secure
	b.) Check for deformations and cracks
M	2.) Check Roof Components:
	a.) Make sure roof structural members are in place
	b.) Inspect for loose or missing roof sheets
	c.) Inspect for loose or missing skirt sheets
	d.) Inspect roof & skirt sheets for signs of corrosion

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D.) Inspect #20 Treatment Vessel:

1.) Inspect the Containment Area:

- D — a.) Inspect walls and foundations for cracks and erosions
- D — b.) Check surrounding area for signs of leaks or spills
- D — c.) Make sure containment drain valve is closed

2.) Inspect Vessel:

- M — a.) Inspect agitator electrical connection and oil level in the gear box
- W — b.) Inspect the exterior of the vessel for cracks, seam leaks and corrosion
- M — c.) Check the vessel legs and supports for signs of fatigue or cracks
- W — d.) Inspect all fittings and valves for signs of leaking.

E.) Inspect 50 GPM Transfer Pump:

- D — 1.) Check packing for signs of leaking
- [illegible] — 2.) Check head gaskets for signs of leaking
- 3.) Electrical connection to the motor
- W — 4.) Check for loose fittings on the suction and discharge piping
- M — 5.) Check the oil level in the gear box

F.) Inspect the Treatment Straining Bin:

- D — 1.) Check surrounding area for signs of leaks
- D — 2.) Check the exterior of the bin for signs of leaking, corrosion or cracks
- M — 3.) Check the legs and supports for signs of fatigue or cracks
- M — 4.) Inspect the columns and roof supports for fatigue or cracks
- M — 5.) Check roof for signs of leaking
- D — 6.) Inspect attached fittings and valves for signs of leaking
- W — 7.) Make sure the straining grates are inplace and secure

l ency		
	G.)	Inspect 100 GPM Transfer Pump:
D	1.)	Inspect surrounding area for signs of leaking
D	2.)	Inspect the foundation for cracks and erosion
D	3.)	Inspect mechanical seal area for signs of leaking
D	4.)	Check the oil level and pressure in the cooling reservoir for the mechanical seal (½ full & 20 psi)
D	5.)	Check the head gasket for signs of leaking
W	6.)	Inspect the electrical connection to the motor
W	7.)	Check for loose fittings on the suction and discharge piping
	H.)	Inspect inter-connecting, piping in Location A, between Location A and B and between Location A and C:
W	1.)	Inspect pipe supports for cracks and signs of corrosion
D	2.)	Inspect pipe fittings and valves for signs of leaking
D	3.)	Inspect surrounding areas for signs of leaking
W	4.)	Check valves for ease of operations and condition of packings
	I.)	Inspect Electrical Components:
D	1.)	Make sure electrical control box door is closed and secured
1	2.)	Inspect the external condition of the electrical conduit for corrosion and integrity. Also check condition of supports
W	3.)	Inspect start-stop station for condition and operation
	J.)	Inspect the Tools:
W	1.)	Check operation and for cracks on the drum carts
W	2.)	Inspect the drum trolley: a.) Check operation up and down b.) Check for oil layer on the chain for the lift device.
W		c.) Inspect the drum attachment for cracks and deformation
D	3.)	Check the manual tools in the area for non-sparking: a.) Hammers b.) Chisels c.) Bung wrenches d.) Scrapers e.) Pipe wrenches

ency K.) Inspect Safety Equipment:

D 1.) Check the placement and condition of two sets of warning signs on the west side of the facility

D 2.) Inspect two fire extinguisher stations
- a.) Covers on the extinguishers
- b.) Extinguishers in place
- c.) Charge of the extinguishers, arrows in the green portion
- d.) Signs above the stations

3.) Inspect the fire fighing foam station at the adjacent Additives Facility:
- D a.) Inspect Hose reels for ease of turning
- D b.) Make sure hose is on the reel and covers are in place
- D c.) Check for the two spanner wrenches
- W d.) Inspect the fire booster pump, turn pump shaft and inspect the suction and discharge piping for integrity
- D e.) Check for the placement of the foam pickup nozzle and the water fog nozzle
- W f.) Inspect the lids and count a minimum of six 5 gal pails of Universal Foam. Lift each pail to check for volume of the contents
- W g.) Inspect the condition of the pipe threads at the hose to pump connector
- D h.) Make sure the fire pump is drained
- D i.) Check electrical connections to the pump motor and power to the main disconnect switch
- W j.) Inspect the inter connecting piping between the water tank and the fire pump for leaks and operation of valves
- D k.) Check for placement of sign "Fire Hose Connection"

W L.) Container and Container Storage Area Inspection

1.) Walking between the rows of stored hazardous waste containers inspect the following:
- a.) Surrounding areas for signs of container leaking
- b.) Condition of pallets for broken slates or unsecure stacks
- c.) Inspect the containers for signs of deterioration caused by erosion or mishandling.

2.) Inspect the containment area base and burm for cracks and signs of erosion

3.) Observe the general appearance of the rows and stacking procedures for conformity

Area Schedule May 1986

Location B - Reclaim Area

Frequency		
	A.)	Inspect the two waste unloading stations UR#1 and UR#2
	1.)	Inspect the 90 GPM unloading pumps:
D	a.)	Check the unloading suction hoses for cracks, swelling and loose fitting
D	b.)	Check the unloading strainers for leaks around the top gasket, placement of the cover bolts and and for loose fittings on the suction and discharg piping
D	c.)	Inspect the inter connecting piping, valves and fittings for signs of leaking
W	d.)	Check the inter connecting piping valves for packing leaks and operation
D	e.)	Check pump packing for signs of leaking
D	f.)	Check pump head gasket for signs of leaking
D	g.)	Check pump bleeder valve for operation and signs of leaking
W	h.)	Electrical connections to the pump motors
M	i.)	Check the oil level in the gear box
W	j.)	Inspect the pump foundation for cracks and signs of erosion
D	2.)	Inspect the surrounding areas for signs of leaks
W	3.)	Check for the placement of yard light above each un-loading pump
D	4.)	Inspect Containment Area
	a.)	Inspect walls and foundations for cracks and erosion
	b.)	Check surrounding area for signs of leaks or spill
	c.)	Make sure containment drain valve is closed
	B.)	Inspect the two Crude Charge Pumps:
W	1.)	Inspect the pump foundation for cracks and signs of erosion
W	2.)	Check pump stands for cracks and signs of corrosion
D	3.)	Check pump packing and head gasket for signs of leaking
D	4.)	Check the bleeder valves for operation and signs of leaking
W	5.)	Check the electrical connection to the motors
D	6.)	Check for loose fittings and signs of leaking on the suction and discharge piping
M	7.)	Check the oil level in the gear boxes
D	8.)	Inspect the inter connecting piping valves for operation and signs of packing leaks
W	9.)	Check for the placement of the yard light above the Crude Change Pump Station
D	10.)	Inspect the inter connecting piping and fittings between the Crude Charge Pump Station and the Reclaim Facility for signs of leaks.
D	11.)	Check the surrounding area for signs of leaks

Frequency	
	C.) Inspect the Reclaim Location B Containment Area:
W	1.) Inspect the dike walls for excessive wear, damage or erosion
W	2.) Check for the position of dike wall barrier rope and supports
D	3.) Inspect the surrounding areas inside and outside the containment area for signs of leaks
W	4.) Inspect the tank base and foundations for cracks and erosion
W	5.) Inspect the 4 walk over ramps for excess wear
D	6.) Make sure containment drain valve is closed
	D.) Inspect the Hazardous Waste Storage Tanks 1A,1B,116-126
	1.) Safety Equipment:
D	a.) Check overfill alarm by pulling the manual checker and signaling an overfill condition
D	b.) Inspect the position of Breather and Arrestor assemblies (Note - internals will be checked annually when tank wall thickness readings are taken)
D	c.) Check level gauge for freedom of movement and compare level to last reported outage
	2.) Vessel inspection:
W	a.) Inspect the exterior of the vessel for cracks, seam leaks and corrosion
M	b.) Where applicable check the vessel legs and supports for signs of fatigue, cracks and fire proofing
D	c.) Inspect all fittings and valves for signs of leaking
D	d.) Check surrounding area for signs of leaking
	E.) Inspect inter connecting piping in Location B
W	1.) Inspect pipe supports for cracks and signs of corrosion
D	2.) Inspect pipe fittings and valves for signs of leaking
W	3.) Check valves for ease of operation and condition of packing
D	4.) Inspect surrounding area for signs of leaking
	F.) Inspect Electricl Components:
D	1.) Make sure electrical control box doors at UR#1 and UR#2 are closed and secure
D	2.) Inspect the Overfill Alarm Control Cabinet at UR#2
	a.) Control box door is closed and secure
	b.) System silence switch is on
	c.) System warning light is intact
	d.) Electrical connections appear secure
M	3.) Inspect the external condition of the electrical conduit for corrosion and integrity. Also check condition of conduit supports
W	4.) Inspect start-stop stations for condition and operation

Frequency G.) Check the manual tools in the area for non-sparking:

D 1.) Hammers
2.) Chisels
3.) Bung wrenches
4.) Scrapers
5.) Pipe wrenches

H.) Inspect Safety Equipment:

D 1.) Check the placement and condition of six sets of warning signs:
a.) 2 on west dike wall of Location B
b.) 1 on east leg of #24 structure
c.) 1 on east leg of Reclaim cooling tower structure
d.) 1 on east wall of Reclaim Building
e.) 1 on west wall of Reclaim Building

D 2.) Inspect 3 fire extinguisher stations located at UR#1, UR#2 and Crude Charge Pump Station:
a.) Covers on the extinguishers
b.) Extinguishers in place
c.) Charge of the extinguisher, arrows in the green portion
d.) Signs above the stations

3.) Inspect 150# Dry Chemical Engine next to the Boiler Room:
D a.) Check the ease of opening the fire house sliding doors
M b.) Inspect the fire house for damage and corrosion
D c.) Check the nitrogen charge on the engine (above 2000 psi)
D d.) Check for attachment of instruction card
M e.) Check freedom of wheel movement
D f.) Check warning signs about blocking fire house door

4.) Inspect the fire fighting foam station at the adjacent Reclaim Facility:
D a.) Inspect hose reels for ease of turning
D b.) Make sure hose is on the reel and covers are in place
D c.) Check for the two spanner wrenches
W d.) Inspect the fire booster pump, turn pump shaft and inspect the suction and discharge piping for integrity
D e.) Check for the placement of the foam pickup nozzle and the water fog nozzle
W f.) Inspect the lids and count a minimum of six 5 gal pails of Universal Foam. Lift each pail to check for volume of the contents.
W g.) Inspect the condition of the pipe threads at the hose to pump connector
D h.) Make sure the fire pump is drained
D i.) Check electrical connectors to the pump motor and power to the main disconnect switch

Frequency	
W	j.) Inspect the inter connecting piping between the water tank and the fire pump for leaks and operation of valves
D	k.) Check for placement of sign "Fire Hose Connection"
	I.) Inspect 1002 Storage Tank
	1.) Safety Equipment:
D	a.) Check overfill alarm by pulling the manual checker and signaling an overfill condition
D	b.) Inspect the position of Breather and Arrestor assemblies (Note- internals will be checked annually when tank wall thickness readings are taken)
D	c.) Check level gauge for freedom of movement and compare level to last reported outage
	2.) Vessel Inspection:
W	a.) Inspect the exterior of the vessel for cracks, seam leaks and corrosion
D	b.) Inspect all fittings and valves for signs of leaking
D	c.) Check surrounding area for signs of leaking
	3.) Inspect inter connecting piping & pump at 1002 Storage Tank:
W	a.) Inspect pipe supports for cracks and signs of corrosion
	b.) Inspect pipe fittings and valves for signs of leaking
W	c.) Check valves for ease of operation and condition of packing
W	d.) Inspect the pump foundation for cracks and signs of erosion
D	e.) Check head gasket and mechanical seal area for signs of leaking
W	f.) Check the electrical connection to the motor
D	g.) Check for loose fittings and signs of leaking on the suction and discharge piping
D	h.) Check for placement of the run light and it's operation
D	i.) Inspect the inter connecting piping and fittings between the pump at 1002 tank and the boiler room for signs of leaking
	4.) Inspect electrical components at 1002 tank:
D	a.) Inspect the overfill alarm control cabinet
	I.) Control box door is closed and secure
	II.) System silence switch is on
	III.) System warning light is intact
	IV.) Electrical connections appear secure
M	b.) Inspect the external condition of the electrical conduit for corrosion and integrity. Also check condition of conduit supports
W	c.) Inspect emergency kill switch at the pump for condition and operation

Frequency		
	5.)	Inspect the containment area for 1002 tank:
W	a.)	Inspect the dike walls for excessive wear, damage or erosion
W	b.)	Check for the position of dike wall barrier rope and supports
D	c.)	Inspect the surrounding areas inside and outside the containment area for signs of leaks
W	d.)	Inspect the walkover ramp for excess wear

Area Schedule May 1986

Location C - Injectant Storage Area

Frequency		
	A.)	Inspect the Waste Unloading Station UR3#
	1.)	Inspect the Unloading Pumps:
D	a.)	Check the unloading suction hoses for cracks swelling and loose fittings
D	b.)	Check the unloading strainers for leaks around the top gasket, placement of the cover bolts and for loose fittings on the suction and discharge piping
D	c.)	Inspect the inter connecting piping, valves and fittings for signs of leaking
D	d.)	Check the inter connecting piping valves for packing leaks and operation
D	e.)	Check pump packing for signs of leaking
D	f.)	Check pump head gaskets for signs of leaking
D	g.)	Check pump bleeder valve for operation and signs of leaking
M	h.)	Check pipe supports for security and corrosion
W	i.)	Check electrical connections to the pump motors
M	j.)	Check the oil level in the gear box
M	k.)	Inspect the pump foundation for cracks and signs of erosion
D	2.)	Inspect the surrounding areas for signs of leaks (Unloading Spots 1A,2A)
W	3.)	Check for integrity of the concrete barrier wall
D	4.)	Inspect the Containment Area:
	a.)	Inspect walls and foundation for cracks and erorion
	b.)	Check surrounding area for signs of leaks or spills
	c.)	Make sure containment drain valve is closed
	5.)	Inspect the Roof Structure
M	a.)	Check Column floor bolts for security
M	b.)	Inspect Columns and roof structural members for integrity and corrosion
M	c.)	Check for placement and corrosion of roof panels
W	d.)	Inspect the base foundation for cracks and erosion
W	6.)	Check for the placement of yard light and under roof lights
D	7.)	Check for placement of 3 Bump blocks, 2 sets of trailer chocks and sign pertaining to the use of chocks
	B.)	Inspect the 100 GPM Transfer Pump, Injectant Loading Pump and Gorator
D	1.)	Inspect surrounding area for signs of leaking

uency	
W	2.) Inspect the foundation for cracks and erosion (Transfer Pump only)
D	3.) Inspect mechanical seal area for signs of leaking
D	4.) Check the oil level and pressure in the cooling reservoir for the mechanical seal (½full and 20psi)
D	5.) Check the head gasket for signs of leaking
W	6.) Inspect the electrical connection to the motor
W	7.) Check for loose fittings on the suction and discharge piping
	8.) Injectant Loading Pump inspection only:
D	a.) Inspect the ACS strainer and 2-FSI Filters for leaks around the top gasket, placement of the cover bolts and for loose fittings on the suction and discharge piping.
D	b.) Check inter connecting piping, fittings and valves for signs of leaking
M	c.) Inspect the bases on the Injectant Loading Pump and the Gorator
M	d.) Inspect the roof structure & columns for integrity and corrosion
M	e.) Check for placement and corrosion of roof panels
M	f.) Inspect the metal deck and legs of the Injectant Pumping Station for cracks and corrosion
D	g.) Inspect the Injectant loading hose for cracks, swelling and loose fittings
D	h.) Check surrounding area and loading spot LA#1 for signs of leaking
W	i.) Check for the placement of yard light and under roof lights
	C.) Inspect the Injectant Storage Location C Containment Area:
W	1.) Inspect the dike walls for excessive wear, damage or erosion
W	2.) Check for the position of dike wall barrier rope and supports
D	3.) Inspect the surrounding areas inside and outside the containment area for signs of leaks
W	4.) Inspect the 4 walkover ramps for excess wear
	D.) Inspect the Hazardous Waste Storage Tanks 202-206 and 210-21
	1.) Safety Equipment:
D	a.) Check overfill alarm by pulling the manual checker and signaling an overfill condition
D	b.) Inspect the position of Breather and Arrestor assemblies (Note - internals will be checked annually when the tank will thickness readings are taken)

F uency	
D	c.) Check level gauge for freedom of movement and compare level to last reported outage.
	2.) Vessel Inspection:
W	a.) Inspect the exterior of the vessel for cracks, seam leaks and corrosion
D	b.) Inspect all fittings and valves for signs of leaking
D	c.) Check surrounding area for signs of leaking
D	d.) Inspect side agitators on 210,211, & 212 for packing leaks and electrical connections to the motors
W	e.) Inspect agitator nozzles for fatigue or cracks
	E.) Inspect inter connecting piping in Location C and between Location C and Reclaim Facility:
M	1.) Inspect pipe supports for cracks, security and signs of corrosion
D	2.) Inspect pipe fittings and valves for signs of leaking
W	3.) Check valves for ease of operation and condition of packing
D	4.) Inspect surrounding areas for signs of leaking
	F.) Inspect Electrical Components:
D	1.) Make sure electrical control box doors at Waste Unload Station UR#3 and Injectant Loading Pump Station (2) are closed and secure
D	2.) Inspect the Overfill Alarm Control Cabinet at UR#3 a.) Control box door is closed and secure b.) System silence switch is on c.) System warning light is entact d.) Electrical connections appear secure
M	3.) Inspect the external condition of the electrical conduit for corrosion and integrity. Also check condition of conduit supports for corrosion and security
W	4.) Inspect start-stop stations for condition and operation
D	G.) Check the manual tools in the area for non-sparking: 1.) Hammers 2.) Chisels 3.) Bung-wrenches 4.) Scrapers 5.) Pipe wrenches

Frequency		
	H.)	Inspect safety equipment:
D	1.)	Check the placement and condition of three sets of warning signs: a.) 1 on NW corner of dike area b.) 1 on NE corner of dike area c.) 1 on SE corner of dike area
D	2.)	Inspect 2 fire extinguisher stations located at UR#3 and Injectant Loading Pump Station: a.) Cover on the extinguisher b.) Extinguisher in place c.) Charge of the extinguisher, arrows in the green portion d.) Signs above the station
	3.)	Inspect 150# Dry Chemical Engine at the Injectant Storage Area-outside the south dike wall:
D		a.) Check the ease of opening the fire house sliding doors
M		b.) Inspect the fire house for damage and corrosion
D		c.) Check the nitrogen charge on the engine (above 2000 psi)
D		d.) Check for attachment of instruction card
W		e.) Check freedom of wheel movement
D		f.) Check warning signs about blocking fire house door
	I.)	Check the security systems:
M	1.)	Activate the plant wide alarm system by dialing #7 on intercom phone. Check the activation of all three warning sirens
D	2.)	Inspect the service of the intercom phones in the following areas: a.) Additives Facility - services Location A & C b.) Reclaim Facility - Services Location B & D
D	3.)	Check the service for out calling from the phones in the employee change house, production office, office laboratory area and safety office in the warehouse
D	4.)	Inspect the Main Gate Entry System: a.) Check the audio level of the communication system at the gate, main office and production office
D		b.) Check gate opening switches in the main office and production office
W		c.) Check gate open timer-set for less than 30 seconds
D		d.) Check activation of gate photo eye to stop gate closing
D		e.) Check key opening system

Frequency		
D	5.)	Check following gates for security: (closed and locked) a.) 2 auxilary gates on East fence line b.) Rail gate and walk gate on South fence line c.) Auxilary gate on West fence line
D	6.)	Inspect the entire site fence line: a.) Check for weak or damaged line poles b.) Openings in the fence fabric c.) Erosion causing more than a 4" difference between the ground and the bottom of the fence

J.) Inspect Hazardous Atmosphere Entry Equipment

M 1.) 3 M Hose Mask:

a.) Helmet
- -check for cracks in the hardhat, face shield and breathing tube nipple.
- -check for holes or tears in the shroud.
- -inspect integrity of the helmet suspension and then fit.
- -check visability through face shield. Clean if necessary

Hood
- -because these hoods are disposable use a new hood for every entry.
- -check hood and view opening for holes and tears.
- -check collar assembly and breathing tube nipple for cracks.
- -fit hood to collar assembly.

b.) Breathing Tube
- -check tube for cracks, deterioration or holes by pulling to increase length.
- -check the 2 fastners for reliability.
- -attach the breathing tube to the Helmet or Hood nipple and to the Air Regulating Valve Assembly with the 2 fastners.

c.) Air Regulating Valve Assembly
- -check for cracks in the housing
- -check all connections and the spindle nut.

Frequency

d.) High Pressure Hose
- check for cracks deterioration and holes.
- check attachment to the outlet of the flowmeter.

e.) Flowmeter
- check operator protection shield for cracks and visability.
- check the integrity of the meter tube.
- check the connection to and from the flowmeter.

f.) Pressure Regulator w/Hose
- check for cracks, deterioration and holes in the hose.
- check hose connection to the regulator.
- check operation of the regulator adjustment nob. (leave nob turned out)
- check regulator attachment to the breathing air cylinder.

g.) Breathing Air Cylinders and Cart
- check pressure on both cylinders by attaching the regulator and opening cylinder valve. A full cylinder should read 2200#. Do not use a cylinder read below 400#.
- reattach regulator to the first cylinder.
- inspect the cart for damage and readiness.

M 2.) MSA Air Mask:

a.) Mask Assembly
- check for contamination, damage and deterioration.
- check visability and clean if necessary.
- fit the mask and check for air leaks by closing off the inlet of the Breathing Tube.

b.) Breathing Tube
- check for cracks, deterioration and holes by stretching the tube length.
- check the connection to the mask.

I quency

c.) Regulator Assembly

-inspect for surface damage and deterioration of the assembly and high pressure hose.
-with mask and breathing tube attached open main line (yellow) and cylinder valve to pressurize the regulator and hose. Close the cylinder valve, watch the regulator gage for a drop in the reading (leak indication). Breathe unit down until the Audit-Larm rings. Check the regulator gage for the pressure (alarm should ring at about ¼ full pressure or 550#). With the cylinder valve closed, breath out the remaining pressure.

d.) Air Tank -check the tank pressure. 2200# is full and will give approximately 30 minutes of air. Do not use a cylinder below 500#.
-check the Harness for wear and function of the hardware.
-fit the harness.

e.) Emergency Horn

-check sound by depressing button for a short burst.

M 3.) Harness -prior to each use, carefully inspect the harness and securing lanyard for indication of wear or deterioration.
-check for loose threads, pulled rivets, cuts, abrasion or evidence of chemical or physical exposure that may hve weakened the material or assembly.
-untangle the lanyard and fit the harness

Frequency

1.) General condition of the unit, pouch and belt.

2.) Check battery charge.

3.) Check for signal activation and/or voice amplification.

D	O.)	Make an approximate inventory of the sand pile at the front gate. The pile should be approximately 3 yards (volume 4 1/2' X 4 1/2' X 4 1/2').
W	P.)	Inspect 90 GPM Pump located in the Barrel House for damage and readiness.
D	Q.)	Check quantity of Poly Coated Protective Suits stored in maintenance office. Minimum quantity is 10 suits.

Frequency

K.) Inspect and Inventory manual tools located on west exterior wall of Safety Office for emergency spill response:

1.) 2 shovels square

2.) 2 shovels round

3.) 2 rakes

4.) Barrier Rope (200')

D L.) Inspect and Inventory Spill Response Kits located in the following locations:

1.) Epoxol Facility

2.) Additives Facility

3.) Injectant Unload Facility (Location C)

4.) Batch Manufacturing Facility

5.) Reclaim Facility (Location D)

6.) Reclaim Crude Unload Facility (Location B)

Inventory for the following items and minimum quantities:

1.) 2 - Booms (S-53) 20' long and 3" Diam.

2.) 50 - Pads (S-74) 18" x 18" x 3/16"

annually M.) The following emergency equipment will be inspected by an authorized outside firm per the attached outline (Page 18-24):

1.) 20# Hand Dry Chemical Extinguishers

2.) 120# Portable Dry Chemical Extinguishers

3.) Fire Hoses

4.) Stationary Fire Pumps

5.) Self Contained Breathing Apparati

D N.) Inspect and Inventory portable emergency signal and communication devices:

1.) PAL III Personal Alert (5 units)

2.) VASP-2 Voice Amplification and Personal Alert (3 units)

The inspection will cover the following items:

HOOSIER FIRE EQUIPMENT INC

4009 MONTDALE PARK DRIVE VALPARAISO, INDIANA 46383
PHONE 219-462-1707
TOLL FREE 800-552-2691

May 6, 1987

American Chemical Service
Post Office Box 190
Griffith, Indiana 46319

Attention: Mr. John Murphy

Dear Mr. Murphy:

Enclosed please find copies of our Procedures for your Annual Fire Extinguisher and 30 Minute Breathing Apparatus Inspections. We are also enclosing a chart showing the Service Test Pressure of your fire hose.

We hope this is the information you require and if we can be of further service, please feel free to contact this office at any time. For your convenience our toll free telephone number is 1-800-552-2691.

Thank you.

Yours very truly,

HOOSIER FIRE EQUIPMENT, INC.

Jim Daly

JAMES E. DALY
Sales Representative

JED/ps

Encl.

Fire Extinguishers

PROCEDURES FOR INSPECTIONS

MONTHLY, QUARTERLY, SEMI-ANNUALLY, ANNUALLY

1. IN DESIGNATED PLACE
2. OPERATING INSTRUCTIONS LEGIBLE AND FACE OUTWARD
3. SEAL NOT BROKEN
4. OBVIOUS PHYSICAL DAMAGE, CORROSION, CLOGGED NOZZLES OR LEAKAGE
5. PRESSURE IN OPERATING RANGE
6. LOOSEN POWDER, WEIGH CO-2
7. ANTI-FREEZE WILL BE SHOT OFF FOR PROPER VALVE AND GAUGE OPERATION
8. TAG - SERVICED

PROCEDURES FOR SIX YEAR MAINTENANCE

1. DEPRESSURIZED - OBSERVE GAUGE OPERATION
2. DISASSEMBLE VALVE AND CHECK ALL PARTS
3. CLEAN THOROUGHLY
4. INSPECT POWDER
5. REASSEMBLE, PRESSURIZE, AND LEAK TEST
6. REPLACE OLD SIX YEAR STICKER WITH NEW UNLESS IN CURRENT YEAR
7. TAG - SERVICED

LINED INDUSTRIAL STANDPIPE, AND FIRE DEPARTMENT HOSE

TRADE SIZES, INCHES	JACKETS	NEW HOSE RATED ACCEPTANCE TEST PRESSURE, PSI	SERVICE TEST PRESSURE, PSI
1½" Thru 2½"	Single	300	150
1½" Thru 4½"	Single	400	250
1½" Thru 2½"	Single	500	250
1½" Thru 4"	Multiple	400	250
1½" Thru 4"	Multiple	600	250

PROCEDURES FOR INSPECTING CUSTOMER'S SELF CONTAINED BREATHING APPARATUS

1. CHECK PRESSURE ON CYLINDER GAUGE
2. CHECK HYDROSTATIC TEST DATE ON CYLINDER
3. CHECK PHYSICAL CONDITION OF APPARATUS, HARNESS AND STRAP ASSEMBLY, ETC.
4. CHECK FACEPIECE AND BREATHING TUBE FOR CRACKS, ETC.
5. CHECK OPERATION OF BOTH THE MAIN-LINE AND BY-PASS VALVES
6. PERFORM FUNCTIONAL TEST BY "BREATHING" THE UNIT
7. CHECK PROPER OPERATION OF ALARM BELL
8. CLEAN AND SANITIZE FACEPIECE

(COMPLETE AND RETURN TO:)

Test Conducted by: ______

Witnessed by: ______

Report No. A- ______

NAME OF RISK: AMERICAN CHEMICAL DATE: 10/29/86

LOCATION: GRIFFITH, INDIANA TOWN: ______

[M]AKE PEERLESS Model or type VERTICAL TYPE Serial No. --------

Rated Capacity 1500 gpm. at rated head 130 psi., ft. at rated speed 1700 rpm.

Net pressure at shutoff 166 psi. Net pressure at 150% rated capacity 93.0 psi.

Brake horsepower at rated conditions ______ Max. brake H.P. at rated speed at any capacity 148

Horizontal, vertical, turbine 4.95 stages impeller dia. 103/8 inches.

[PU]MP OPERATES: Manual, Automatic Cut in ----- psi Cut out ----- psi.

[D]RIVEN BY: Electric motor, steam, turbine, gasoline, diesel, engine, water wheel, no clutch.

[SU]CTION FROM: SMALL POND Capacity ? Gals.

Lift ______ ft. Vertical Turbine Discharge Head to Water Level ______ Ft.

[H]ead ______ ft., psi. Vertical Turbine Lowest Impeller to Water Level ______ Ft.

NO [JO]CKEY PUMP

[JO]CKEY OR MAKE-UP PUMP: Make ______ Type ______ Rated Capacity ______ gpm.

Rated Head ______ psi., ft. Cut-in ______ psi., Cut-out ______ psi.

Centrifugal or Positive Displacement Type. Relief Valve Setting ______ psi.

[S]PECIAL COMMENTS PUMP GOOD

Condition	Hose layout normally 50' for each outlet	Size of test tip	Pitot	G.P.M.	Pump Pressures: Vertical Turbine Discharge Gage to Water Level or Suction — Discharge PSI.	PSI.	Net PSI. Ft.	R.P.M.
Churn	---	1 3/4	--	--		170	170	1700
100% cap.	1	1 3/4	12					
	2	1 3/4	12		1575	130	130	1700
	3	1 3/4	12					
	4	1 3/4	12					
150% cap.	5	1 3/4	12					
	1	1 3/4	24					
	2	1 3/4	24		2230	96	96	1700
	3	1 3/4	24					
	4	1 3/4	24					
	5	1 3/4	24					

Check engine tachometer against Insp. Speed Counter. Plot test points

TESTING EPOXOL DELUGE SYSTEM

DATE: ______________________

NITIAL TESTER: ______________________

______ 1.) Inform Epoxol Operators that a test is going to be performed.

______ 2.) Close Main Deluge Valve (yellow tag) in Fire House.

______ 3.) Attach hose length to test nozzle. Make sure valve is closed and the ½" drain valve is open.

______ 4.) Attach hose to monitor and attach nozzle to monitor. Aim at Holding Pond.

______ 5.) Run 110V extension cord from Electrical Building to to Epoxol Building roof.

______ 6.) Plug in heat lamp and activate heat sensor __________ Location

______ 7.) Horns should sound. Measure seconds until activation of Fire Pump. ______________ Seconds

______ 8.) Slowly open test nozzle and close ½" drain valve.

______ 9.) Run Fire Pump water into Holding Pond for 30 minutes.

______ 10.) During pump run replace heat sensor and remove 110V extension cord.

______ 11.) At end of 30 minutes trip off Fire Pump Main at Control Cabinet.

______ 12.) Check for activation of 440V power drop horn. Leave horn on.

______ 13.) Check 2 manual activation switches on south wall of Epoxol Building. Activation Horn should sound.

South East Ground Switch ______________________

South 2nd Floor Switch ______________________

______ 14.) Rearm Fire Pump Main at Control Cabinet.

______ 15.) Open Main Deluge Valve (yellow tag) in Fire House.

INITIAL

______	16.)	Check 110V Pilot Light on roof of Epoxol Fire House.
______	17.)	Break down & drain Fire Hose and place back on reel with cover.
______	18.)	Drain monitor, return nozzle to Fire House, return to location and cover monitor.
______	19.)	Close valve at test nozzle and open ½" drain valve.
______	20.)	Count number of Foam 5's ______________.
______	21.)	Check for placement of foam & water nozzles.
______	22.)	Walk 4" Deluge Main and inspect inside piping from 2nd floor catwalk.
______	23.)	Inform Epoxol Operators the test is completed.
______	24.)	Return Test Sheet to Plant Engineer.

Inspections; 320 IAC 4.1-49-4

Maintenance Inspection Procedure

A.) On all operating days between 7^{30} and 8^{30} AM the Still Area (Location D) is inspected by facility personnel.

B.) The Still Area has a Schedule to outline the inspection procedure and to identify the types of problems to look for during the inspection. Frequency determines how often an item is checked:

D - Daily on operating days
W - Weekly
M - Monthly

The frequency of the inspection is based on past years of operating experience and previous Maintenance Logs.

C.) If a problem is observed during the inspection, a Maintenance Action Sheet is filled out listing the problem and location.

D.) After the inspection the Monthly Inspection Log is initialed and noted as follows:

OK - Area shows no apparent problems
NOK - Area has the problems as listed on the Maintenance Action Sheet.

E.) The Monthly Inspection Log and Maintenance Action Sheets are reviewed by the Maintenance Supervisor the same operating day. If maintenance action is required, and entry is made into the Maintenance Log.

F.) The Maintenance Log is used to schedule maintenance action.

G.) When the maintenance is performed and the problem is corrected the Maintenance Log is dated and the Maintenance Action Sheet is dated and initialed.

H.) All records reflecting maintenance in Location D must be kept for 3 years.

DEC 1 9 1986

AREA SCHEDULE

Location D - Stills

Frequency A.) #1 Still System:

1.) Inspect #1 Heat Exchanger:

D a.) Check interconnecting pipe, fillings, valves and seams for signs of leaking.
W b.) Check supports and foundations for cracks, erosion and corrosion.
W c.) Check the condition of the insulation.
D d.) Check surrounding area for signs of leaking.

2.) Inspect #1 Recirculation Pump:

D a.) Inspect surrounding area for signs of pump leaking
D b.) Inspect interconnecting pipe, fittings, valves and seams for signs of leaking.
D c.) Inspect the flange mounting of the pump to the vessel for loose or missing bolts and the integrity of the pump nozzle.
D d.) Check level of the barrier fluid tank for the double mechanical seal.
M e.) Take a sample of the barrier fluid and have the lab analyze for seal seepage.
W f.) Check oil level in bearing housing.
W g.) Inspect the drive belts for cracks and excessive wear.
W h.) Inspect electrical connections for security and corrosion.

3.) Inspect #1 Still:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.
W b.) Check supports and foundation for cracks, erosion and corrosion.
D c.) Check surrounding area for signs of leaking.
W d.) Check the condition of the fireproofing for cracks and erosion.
W e.) Check the condition of the insulation.
D f.) Check for the placement of the monitoring and safety devices:
- Rupture Disc
- Pot temperature thermocouple
- Vapor Temperature thermocouple

D g.) Check with the operator and #1 Still Run Sheet for the performance of the still monitoring devices.

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Frequency		
	4.)	Inspect #1 Condenser:
D	a.)	Check inter connecting piping, fittings, valves and seams for signs of leaking.
	b.)	Check the supports to #1 Still for cracks and corrosion.
D	c.)	Check the surrounding area for signs of leaking.
D	d.)	Check for the placement of the monitoring devices: - Cooling water in and out temperature thermocouples. - Cooling water flow switch. - Vacuum pressure indicator and vacuum control valve.
	5.)	Inspect #1 Product Pump:
D	a.)	Inspect surrounding area for signs of pump leaking.
D	b.)	Inspect inter connecting pipe, fittings, valves and seams for signs of leaking.
W	c.)	Check the foundation for signs of cracking, erosion and corrosion.
W	d.)	Check oil level in bearing housing.
W	e.)	Inspect electrical connection for security and corrosion.
D	f.)	Check for the placement of the monitoring devices: - 2 - flow indicators
	6.)	Inspect Residue Pump:
D	a.)	Inspect surrounding area for signs of pump leakage.
	b.)	Inspect inter connecting pipe, fittings, valves and seams for signs of leaking (To #1, #2, #3; #7 Stills).
W	c.)	Check the foundation for signs of cracking, erosion and corrosion
D	d.)	Check pump mechanical seal for signs of leaking.
D	e.)	Check pump bleeder valve for operation and signs of leaking.
W	f.)	Check electrical connections to the pump motor for cracking or corrosion
D	g.)	Check level of the Barrier Fluid Tank for the double mechanical seal.
M	h.)	Take a sample of the Barrier Fluid and have the lab analyze for seal seepage.
	7.)	Inspect #1 Receiver Tank:
D	a.)	Check inter connecting piping, fittings, valves and seams for signs of leaking.
W	b.)	Check supports and foundation for cracks, erosion and corrosion.
D	c.)	Check surrounding area for signs of leaking.
W	d.)	Check the condition of the fireproofing for cracks and erosion.
D	e.)	Check for the placement of the monitoring and safety devices: - Flame Arrestor - Level Indicator

quency B.) General Area Inspections:

D 1.) Inspect for the placement of outside and inside lighting. If possible check for the operation.

D 2.) Inspect the floor trench:

a.) Inspect for solid materials and blockage.
b.) Inspect for liquid level (should not be present).
c.) Check for placement of floor grating covers.
d.) Check for cracks and signs of erosion of walls and base.

D 3.) Inspect Spill Containment:

a.) Check for Roof and cover placement.
b.) Check walls and base for cracks and signs of erosion
c.) Inspect for liquid level (should not be present).
d.) Inspect inlet flow pipe for signs of corrosion or blockage.

D 4.) Check operation of ventilation fans in the area. (4)

M 5.) Inspect the external condition of the electrical conduit for corrosion and integrity. Also check condition of conduit supports for corrosion and security.

W 6.) Inspect the start-stop stations for condition and operation:

a.) #1, #2, & #3 Recirculation Pumps.
b.) Residue Pump
c.) #1, #2, & #3 Product pumps
d.) #7 Reflux pump.

D 7.) Inspect Control Panel inicator lights and talk to operator concerning malfunctions.

D 8.) Check the manual tools in the area for non-sparking:

a.) Hammers
d.) Chiesels
c.) Bung-wrenches
d.) Scrapers
e.) Pipe wrenches

9.) Inspect safety equipment:

D a.) Check the placement and condition of two sets of warning signs:
- 1 on SW corner of Reclaim Building
- 1 on SE corner of Reclaim Building

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D b.) Inspect 5 fire extinguisher stations located in Location D:
- Cover on the extinguisher
- Extinguisher in place
- Charge of the extinguisher, arrow in green portion
- Signs above the stations

D c.) Inspect the Deluge System
- 2 automatic valves in place.
- Manual valve box in place and operable.
- Visual inspection of the Deluge System pipework for placement.

C.) #2 Still System:

1.) Inspect #2 Heat Exchanger:

D a.) Check interconnecting pipe, fittings, valves and seams for signs of leaking.

W b.) Check supports and foundation for cracks, erosion and corrosion.

W c.) Check the condition of the insulation.

D d.) Check surrounding area for signs of leaking.

2.) Inspect #2 Recirculation Pump:

a.) Inspect surrounding area for signs of pump leaking.

D b.) Inspect inter connecting pipe fittings, valves and seams for signs of leaking.

D c.) Inspect the flange mounting of the pump to the vessel for loose or missing bolts and the integrity of the pump nozzle.

D d.) Check level of the barrier fluid tank for the double mechanical seal.

M e.) Take a sample of the barrier fluid and have the lab analyze for seal seepage.

W f.) Check oil level in bearing housing

W g.) Inspect the drive belts for cracks and excessive wear.

W h.) Inspect electrical connections for secruity and corrosion.

3.) Inspect #2 Still:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.

W b.) Check supports and foundation for cracks, erosion and corrosion.

D c.) Check surrounding area for signs of leaking.

d.) Check the condition of the fireproofing for cracks and erosion.

W e.) Check the condition of the insulation.

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Frequency	
D	f.) Check for the placement of the monitoring and safety devices: - Rupture Disc - Pot temperature thermocouple - Vapor Temperature thermocouple
D	g.) Check with the operator and #2 Still Run Sheet for the performance of the still monitoring devices.
	4.) Inspect #2 Condenser:
D	a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.
W	b.) Check the supports to #2 Still for cracks and corrosion.
D	c.) Check the surrounging area for signs of leaking.
D	d.) Check for the placement of the monitoring devices: - Cooling water in and out temperature - Cooling water flow switch - Vacuum pressure indicator and Vacuum Control Valve.
	5.) Inspect #2 Product Pump:
D	a.) Inspect surrounding area for signs of pump leaking.
D	b.) Inspect inter connecting piping, fittings valves and seams for signs of leaking.
W	c.) Check the foundation for signs of cracking, erosion and corrosion.
W	d.) Check oil level in bearing housing,
W	e.) Inspect electrical connecting for security and corrosion.
D	f.) Check for the placement of the monitoring devices -2 - Flow indicators
	6.) Inspect #2 Receiver Tank:
D	a.) Check inter connecting piping, fittings valves and seams for signs of leaking.
W	b.) Check supports and foundation for cracks, erosion and corrosion.
D	c.) Check surrounding area for signs of leaking.
W	d.) Check the condition of the fireproffing for cracks and erosion.
D	e.) Check for the placement of the monitoring and safety devices: -Flame Arrestor -Level Indicator
	D.) #3 Still Systems
D	1.) Inspect #3 Heat Exchanger: a.) Check inter connecting pipe, fittings, valves and seams for signs of leaking.

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F uency			
W		b.)	Check supports and foundation for cracks, erosion and corrosion.
W		c.)	Check the condition of the insulation.
D		d.)	Check surrounding area for signs of leaking.
	2.)		Inspect #3 Recirculation Pump:
D		a.)	Inspect surrounding area for signs of pump leaking.
D		b.)	Inspect inter connecting pipe, fittings, valves and seams for signs of leaking.
D		c.)	Inspect the flange mounting of the pump to the vessel for loose or missing bolts and the integrity of the pump nozzle.
D		d.)	Check level of the barrier fluid tank for the double mechanical seal.
M		e.)	Take a sample of the barrier fluid and have the lab analyze for seal seepage.
W		f.)	Check oil level in bearing housing.
W		g.)	Inspect the drive belts for cracks and excessive wear.
W		h.)	Inspect electrical connections for security and corrosion.
	3.)		Inspect #3 Still:
D		a.)	Check inter connecting piping, fittings, valves and seams for signs of leaking.
W		b.)	Check supports and foundation for cracks, erosion and corrosion.
D		c.)	Check surrounding area for signs of leaking.
W		d.)	Check the condition of the fireproofing for cracks and erosion.
W		e.)	Check the condition of the insulation.
D		f.)	Check for the placement of the monitoring and safety devices: - Rupture Disc - Pot temperature thermocouple - Vapor temperature Thermocouple
D		g.)	Check with the operator and #3 Still Run Sheet for the performance of the still monitoring devices.
	4.)		Inspect #3 Condenser:
D		a.)	Check inter connecting piping, fittings, valves and seams for signs of leaking.
W		b.)	Check the supports to #3 Still for cracks and corrosion.
)		c.)	Check the surrounding area for signs of leaking.
		d.)	Check for the placement of the monitoring devices: - Cooling water in and out temperature thermocouples.

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- Cooling water flow switch
- Vacuum pressure indicator and Vacuum control valve.

5.) Inspect #3 Product Pump:

D a.) Inspect surrounding area for signs of pump leaking.
D b.) Inspect inter connecting pipe, fittings, valves and seams for signs of leaking.
W c.) Check the foundation for signs of cracking, erosion and corrosion.
W d.) Check oil level in bearing housing.
W e.) Inspect electrical connections for security and corrosion.
D f.) Check for the placement of the monitoring devices:
- 2 - Flow indicators

6.) Inspect #3 Receiver Tank:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.
b.) Check supports and foundation for cracks, erosion and corrosion.
c.) Check surrounding area for signs of leaking.
W d.) Check the condition of the fireproofing for cracks and erosion
D e.) Check for the placement of the monitoring and safety devices:
- Flame Arrestor
- Level Indicator

E.) #7 Still System:

1.) Inspect #7 Still:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.
W b.) Check supports and foundations for cracks, erosion and corrosion.
D c.) Check surrounding area for signs of leaking.
W d.) Check the condition of the insulation.
D e.) Inspect manhead bolts and face for signs of leaking.
D f.) Check for the placement of the monitoring and safety devices:
- Rupture Disc
- Pot temperature thermocouple
- Vapor temperature thermocouple
D g.) Check with the operator and #7 Still Run Sheet for the performance of the still monitoring devices.

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2.) Inspect #7 Condenser:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.

W b.) Check the support structure, anchor bolts and foundation for cracks, erosion and corrosion.

D c.) Check the surrounding area for signs of leaking.

D d.) Check for the placement of the monitoring devices:
- Cooling water in and out temperature thermocouples
- Cooling water flow switch

3.) Inspect #7 Column:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.

W b.) Check supports, anchor bolts and foundation for cracks, erosion and corrosion.

D c.) Check surrounding area for signs of leaking.

W d.) Check the consition of the insulation.

M e.) Inspect catwalk and ladders for cracks and corrosion. During inspections check condition of handholes and bolts. Make close inspection of top monitoring and safety devices.
- Rupture Disc
- Top Column temperature thermocouple
- Top & Bottom Differential Pressure Indicator.

D f.) Check for the placement of the monitoring and safety devices:
- Rupture Disc
- Top Column temperature thermocouple
- Top & Bottom Differential Pressure Indicator

4.) Inspect #7 Receiver:

D a.) Check inter connecting piping, fittings, valves and seams for signs of leaking.

W b.) Check supports and foundation for cracks, erosion and corrosion.

D c.) Check surrounding area for signs of leaking.

W d.) Check the condition of the fireproofing for cracks and erosion.

D e.) Check for the placement of the monitoring and safety devices:
- Rupture Disc
- Level Indicator

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5.) Inspect #7 Reflux Pump:

D a.) Inspect surrounding area for signs of pump leaking.
D b.) Inspect inter connecting pipe, fittings, valves and seams for signs of leaking.
W c.) Inspect the foundation for signs of cracking, erosion and corrosion.
W d.) Inspect electrical connections for security and corrosion.
D e.) Check for the placement of the monitoring devices:
- 2 - Flow indicators

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MONTHLY INSPECTION LOG

Month of __________, 19__

Inspections between 7:30am to 8:30am on all operating days

Location- Location A- Drum Unloading Dock
Location B- Reclaim Crude Storage Area
Location C- Injectant Storage Area

Condition- OK- Location shows no apparent problem
NOK- Location has a problem as listed on the maintenance action sheet

Sign- Inspector signature

DAY	LOCATION A CONDITION	SIGN	LOCATION B CONDITION	SIGN	LOCATION C CONDITION	SIGN
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MONTHLY INSPECTION LOG

Month of __________, 19__

Inspections between 7:30am to 8:30am on all operating days

Location- Location D- Still Areas

Condition- OK- Location shows no apparent problem
NOK- Location has a problem as listed on the maintenance action sheet

Sign- Inspector signature

DAY	LOCATION D CONDITION	SIGN
1		
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MAINTENANCE ACTION SHEET

INSPECTION DATE	LOCATION	DESCRIPTION OF PROBLEM	CORRECTION DATE	DESCRIPTION OF CORRECTION	SIGN OFF

SECTION B:

TASK RISK ANALYSIS

B.) Task Risk Analysis:

This section addresses the requirement to profile a safety and health risk analysis for each site task and operation.

The RCRA operations at ACS contain the following job titles:

1.) Operator
2.) Unloader
3.) Loader
4.) Tractor driver
5.) Laborer
6.) Emergency Response Personnel

The job descriptions for each position are as follows:

1.) Operator

Operators operate the Reclaimation Facility. They distill solvents from hazardous waste in Location D in Vessels (stills) using steam and vacuum. The distillate solvents are stored in the Reclaim tank farm. The residues from the stills are pumped to the Injectant Storage tank farm Location C.

2.) Unloader

Unloaders pump hazardous waste from tank wagons at unloading ramps at Location B and C to storage tanks. They also unload drums of hazardous waste from box trailers in Location A and pump the contents to storage tanks in Location B or C.

3.) Loader

Loaders pump hazardous waste from storage tanks in Location C to tank wagons or tank cars in the loading areas.

4.) Tractor driver

Some shipments of drums of hazardous waste arrive in box trailers which are not the same height as the unloading dock in Location A. The tractor driver unloads the drums from the trailers onto the tractor bucket and transports them to the unloading dock in Location A.

5.) Laborer

Laborers assist the tractor driver and unloaders in the unloading of box trailers and pumping drums. Their efforts are regularly directed by supervisors, unloaders or the tractor driver. They also remove solids from storage tanks and stills.

6.) Emergency Response Personnel

The above 5 category personnel are also required to perform response to emergency situation as described in the Contingency Plan, Section J.

7.) Solids Pail Loader

Solids Pail Loaders fill flammable solid hazardous waste into 6 gallon pails. The operations are conducted in Location A.

Each of these above tasks are analyzed with the use of the Safety and Health Risk Analysis Profile (Attachment B-1). During the analysis, the task is assigned a protection level based on the following criteria:

<u>Level A</u>: Level A protection should be used when:

1.) The hazardous substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system, based on either the measured (or potential for) high concentration of atmospheric vapors, gases, or particulates; or the operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to skin or capable of being absorbed through the intact skin.
2.) Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible, or
3.) Operations must be conducted in confined, poorly ventilated areas and the absence of conditions requiring Level A have not yet been determined.

<u>Level B</u>: Level B protection should be used when:

1.) The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection.
2.) The atmosphere contains less than 19.5 percent oxygen, or
3.) The presence of incompletely identified vapors or gases is indicated by a direct-reading organic vapor detection instrument, but vapors and gases are not suspected of containing high levels of chemicals harmful to skin or capable of being absorbed through the intact skin.

<u>Level C</u>: Level C protection should be used when:

1.) The atmospheric contaminantes, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.
2.) The types of air contaminantes have been identified, concentrations measured and a canister respirator is available that can remove the contaminantes, and
3.) All criteria for the use of air- purifying respirators are met.

Level D: Level D protection should be used when:

1.) The atmosphere contains no known hazard, and
2.) Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemical.

The protection level will determine the types of personal protective equipment required to perform the above mentioned tasks. The Task Risk Analysis will be completed by 1 September, 1987.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE:

INSPECTOR:

TASK:

EMPLOYEE:

LOCATION:

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT:

A B C D E F G H I J K L M N O P Q

1. Receiving and shipping:
   - Dock plates and chocks
   - Job Planning
   - Layout

2. Piling and stacking:
   - Projecting materials
   - Safe heights
   - Floor loads
   - Methods
   - Locations
   - Distance from sprinklers

3. Vehicles:
   - Unauthorized use
   - Operating defective vehicle
   - Reckless/speeding operation
   - Failure to Obey Traffic Rules
   - Other

4. Mechanical material handling:
   - Power cranes
   - Bridge cranes
   - Monorails
   - Hoists

5. General area:
   - Floor condition
   - Special purpose flooring
   - Aisle, Clearance/Markings
   - Floor openings, require safeguards
   - Railings, stairs temp./perm.
   - Dock board (bridges plates)
   - Piping (water-steam-air)
   - Wall damage
   - Ventilation
   - Other

6. Housekeeping:
   - Floors
   - Machines
   - Br[illegible]rea/latrines
   - [illegible]disposal
   - Vending machines/food protection
   - Rodent, insect, vermin control

7. Electricity:
   - Equipment, selection, and installation
   - Switches
   - Breakers
   - Fuses
   - Switchboards
   - Junctions
   - Circuits overloaded
   - Frayed & defective wiring
   - Modern, approved equipment
   - Extensions
   - Tools
   - Motors
   - Grounding
   - Explosion-proof equipment
   - High voltages labeled

8. Lighting:
   - Modern, permanent installation
   - Bright enough
   - Well-diffused
   - Approved installation
   - Independently controlled
   - Not in way
   - No flicker
   - Reflection
   - Proper type
   - Supplementary lighting

9. Heating and ventilation:
   - Warm enough
   - Cool enough
   - Dampness
   - Good, natural, or artificial ventilation
   - Humidity o.k.

10. Dusts, fumes, gases, vapors:
    - Exhaust systems--individual or general
    - Sufficient capacity
    - Right type
    - Efficient

11. Hand power tools:
    - Inspection
    - Storage
    - Repair
    - Maintenance
    - Carrying and handling
    - Safe use
    - Proper type
    - Right size
    - Special tools
    - Grounding

12. Machinery:
    - Unattended machines operating
    - Emergency stops not operational
    - Platforms/ladders/catwalks
    - Instructions to operate/stop posted
    - Maint. being performed on machines in operation
    - Guards in place
    - Pinch points
    - Safety devices o.k.

13. The machine operator:
    - Experienced and trained
    - Cleans machine safely
    - No oiling, adjusting when machine is in motion
    - Safe clothes and shoes
    - Uses personal-protective equipment
    - Uses feeding devices
    - Checks machine before starting
    - Neat--stores tools, etc., properly
    - Lifts safely
    - No unreasonable time limits
    - Regulations
    - Training programs

14. Repetitive motion and fatigue:
    - Muscular strain
    - Pads and cushions
    - Rest periods
    - Chairs and stools

☐ Tired or improperly reacting muscles induce accidents

5. Lifting:
- ☐ Proper grip
- ☐ Safe footing
- ☐ Back straight
- ☐ Knees bent
- ☐ Object not too heavy, slippery, poorly shaped, bulky, etc.
- ☐ Steady motion
- ☐ Carry slowly

16. Protective clothing and equipment:
- ☐ Shoes, gloves, goggles, hats, respirators, etc.
- ☐ Close-fitting clothes
- ☐ Easy-to-remove clothes
- ☐ Good maintenance

17. Horseplay:
- ☐ Big cause of accidents

18. Maintenance:
- ☐ Regular schedule
- ☐ Effective
- ☐ Trained personnel? – (Electricians for electric work, etc.)
- ☐ Good materials and parts
- ☐ Safe methods
- ☐ Machinery shut down and locked?

19. Fire prevention and control:
- ☐ Extinguishers
- ☐ Alarms
- ☐ Sprinklers
- ☐ Smoking rules
- ☐ Exits
- ☐ Assigned personnel
- ☐ Safe conditions
- ☐ Proper storage
- ☐ Dangerous operations separated
- ☐ Flammable materials
- ☐ E[illegible]on-proof fixtures
- ☐ [illegible] disposal

20. Pressure vessels:
- ☐ Experienced personnel in charge
- ☐ Regular inspections
- ☐ Good maintenance and repair
- ☐ Safely located or protected
- ☐ Safety device equipped
- ☐ Safe operating practices

21. Conveyors, elevators, and other lifting devices:
- ☐ Shafts protected
- ☐ Machinery protected
- ☐ No unauthorized use
- ☐ Regular inspection
- ☐ Good maintenance
- ☐ Safety devices o.k.

22. Stairways:
- ☐ Condition good
- ☐ Steps uniform
- ☐ No obstructions
- ☐ Good lighting
- ☐ Clean
- ☐ Dry
- ☐ Wide enough
- ☐ Handrails
- ☐ Not too long--not too, steep

23. Ladders:
- ☐ Rungs and rails
- ☐ Rung spacing o.k.
- ☐ Cages (if fixed type)
- ☐ Safety feet
- ☐ Not painted
- ☐ Stored properly
- ☐ Marked for identification
- ☐ Inspected regularly

24. Noise:
- ☐ Machinery
- ☐ Building [illegible]truction
- ☐ Operat

25. Chemicals, caustics, explosives, flammable liquids, and other dangerous substances:
- ☐ Storage
- ☐ Handling
- ☐ Transportation
- ☐ Protective clothing and equipment
- ☐ Supervision
- ☐ Training
- ☐ Warning signs
- ☐ Amounts

26. First aid:
- ☐ First Aid Kits
- ☐ Stretchers, fire blankets, oxygen

NOTES

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 7-27-87 THRU 8-4-87

INSPECTOR Thomas Murphy

TASK: Laborer

EMPLOYEE: See signoff sheet attached

LOCATION: Plant Wide

PROTECTION LEVEL: A *B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

A B C D E F *G *H I J *K *L M N O *P Q R S *T

☐ —— NORMAL OPERATIONS

O —— EMERGENCY RESPONSE

* —— Upgraded to Protection level 'B' when tasks reguire hazardous entry into stills, tanks, etc. for cleaning purposes.

Laborer

Laborers assist tractor drivers and unloaders in unloading box trailers and pumping drums. Their efforts are regularly directed by supervisors, unloaders or tractor drivers and they wear the same PPE previously mentioned in this section. They also dig solids which collect in the storage tanks and stills during processing. The routine procedures are as follows:

a) The laborer rolls drums from a box trailer to the tractor bucket or the raised pad at Location A.
b) The laborer assists the unloader in pumping drums at Location A by opening bungs on designated drums or transferring the charge pipe from one drum to another which is already opened.
c) The laborer assists the unloader in charging viscous liquids from drums to the small blending tank by rolling drums to the dump box ramp or dumping their contents into the dump box.
d) The laborer assists the unloader in solidifying solid materi... in drums by draining any free liquid from solid drums. This drained liquid is put into drums for future pumping to Location C
e) The laborer rolls empty drums to the spotted trailer.
f) The laborer digs solids which collect in stills and storage tanks during processing. The procedure is covered under the Hazardous Atmosphere Entry Program.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 7-27-87 THRU 8-7-87

INSPECTOR Thomas Murphy

TASK: Tractor Driver

EMPLOYEE: See signoff sheet attached

LOCATION: A, B, & C.

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

A B C D E F G H I J K L M N O P Q R S T

☐ —— NORMAL OPERATIONS

○ —— EMERGENCY RESPONSE

Tractor driver

Some shipments of drums of hazardous waste arrive in trailers which are not the same height as the raised pad at Location A. The tractoe driver unloads the drums from the trailer and hauls them to the raised pad.

a) Unloading trailers of hazardous waste with the tractor.

Trailers, that are not the same height as the raised pad, are usually spotted in the area west of location A. Drums are transferred by the tractor driver to the raised pad. The procedure is as follows:

1) At the direction of the supervisor the tractor driver opens the doors of the trailer.
2) The tractor driver positions the tractor at the rear opening of the trailer with the drum bucket flush with the trailer floor.
3) The tractor driver chocks the trailer to prevent movement in both directions.
4) If there is no strong chemical odor, the tractor driver rolls 6 drums into the tractor bucket. If there is a strong chemical odor, the tractor driver makes his supervisor aware and awaits his instructions.
5) The tractor driver slowly raises the bucket about 6 inches and backs away from the trailer.
6) When the bucket is about 5 feet from the trailer, the tractor driver lowers the bucket to 1 foot from the ground.
7) The tractor driver transports the drums to the raised pad to unload them.
8) When the supervisor approves the drums, the tractor driver rolls them to a designated area.
9) The tractor driver continues to unload the trailer until it is empty.
10) The tractor driver removes the chocks.

c) Still startup

Stills are run at atmospheric or vacuum conditions. At the atmospheric condition the startup procedure is as follows:

1) The operator checks that the atmospheric vent valve on the still is open.
2) The operator sets the vent float in case the still later bumps during heatup. This device prevents the contents of the still from foaming out of the still during the run.
3) The operator closes the valve on the vacuum line to the still.
4) The operator records the time and temperature of the pot, vapor, and the cooling water on the condenser outlet.
5) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig usually. Runs of crude methylene chloride, perchlor, and trichlor require initial pressure settings of 30 psig.
6) The operator monitors the still pot temperature. At 120-150F solvents usually begin to vaporize from crude in the still. The vapors pass to the condensor where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still.
7) The operator turns on the product pump when the distilled solvent first appears in the sight glass. The pump, which can pump ½ to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.
8) The operator records the time and temperature when the still starts to distill.

At the vacuum condition the startup procedure is as follows:

1) The operator closes the atmospheric vent valve on the still.
2) The operator opens the valve on the vacuum line to the still.
3) The operator sets the vacuum controls on 30(no vacuum).
4) The operator turns on the vacuum pump and sets the seal water flow at 5 gallons per minute or 5 psig on gauge.
5) The operator slowly adjusts the vacuum controller to a setting of 15.
6) The operator records the time and temperatures of the pot, vapor, and cooling water on the condenser outlet.
7) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig.
8) The operator monitors the still pot temperature. At 110-130F solvents usually begin to vaporize from the crude in the still. The vapors pass to the condenser where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still. If the material in the sight glass is dirty, the operator turns off steam to the heating coil and sets the vacuum controller to 30. He opens the atmospheric vent on the still after hooking up the nitrogen purge system to the vent.

A check valve on the nitrogen purge system will clatter when the atmospheric condition is reached. The operator removes the nitrogen purge system and goes back to step (1) and starts over again. Any dirty material in the lines is drummed.

9) The operator turns on the product pump when clean distilled solvent first appears in the sight glass. The pump, which can pump ½ to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.

10) The operator records the time and temperature when the still starts to distill.

Operator - Routine procedures

d) Distillation of solvents during run.
During the run the operator watches the sight glass and vacuum indicator. Every other hour the time, vacuum, and temperatures of the vapor, pot, and condenser outlet water are entered on the run sheet. When a receiver almost fills, the operator takes a sample to check for color before pumping the liquid in the receiver. He then pumps it to a storage tank specified by the supervisor. The operator enters the time, storage tank gauge readings, before and after pumping, and the corresponding gallons. The gallons are then subtracted from the total initial charge to the still. The remaining gallons in the still are entered on the still run sheet.

Operator - Routine procedures

e) Sampling of residue to shutdown still.
As solvent is distilled the residue is concentrated and its viscosity or thickness increases. The operator takes a 4 ounce sample from a sample valve on the still coil when approximately 40-50% of the charge volume is distilled. When the sample cools and its consistency is like molasses, the still is shutdown.

Operator - Routine procedures

f) Shutdown of still

The shutdown procedure for a still under vacuum conditions is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the vacuum pump and seal water.
4) The operator attaches the nitrogen purge system to the atmospheric still vent line.
5) The operator opens the still vent valve.
6) The operator opens the nitrogen valve and sets the rotameter at 30 to bring the still back to atmospheric pressure. A check valve on the purge system clatters when atmospheric pressure is reached.
7) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
8) The operator leaves the still recirculating pump on during and after the shutdown.

The shutdown procedure for a still at the atmospheric condition is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
4) The operator leaves the still recirculating pump on during and after the shutdown.

Operator - Routine Procedures

g) Pumping residue to Location C.
Residues are pumped from the stills with a Worthington pump to storage tanks at Location C. Firure 3 shows the stills and pump, and Figure 4 shows the storage tanks at Location C. The procedure for pumping the residue is as follows:

1) The supervisor specifies the proper storage tank at Location C This information is written on a daily run sheet for each still.
2) The operator determines the inches corresponding to the gallons of residue in the still for the specified storage tank. See table below.

Tanks - 202,203 204,205,206 Gallons Residue	Inches	Tanks 210 211,212 Gallons Residue
540	10"	700
810	15"	1050
1080	20"	1400
1350	25"	1750
1620	30"	2100
1890	35"	2450
2160	40"	2800
2430	45"	3150
2700	50"	3500

3) The operator then measures the void space in inches in the storage tank at Location C to check if the tank will hold the gallons of residue figured in tank inches.
4) The operator sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The operator checks the tank overfill alarm.
6) The operator opens the valve on the storage tank.
7) The operator walks the line from the storage tank to the residue pump opening the proper valves and closing unused valves attached to the line.
8)

9) The operator opens the bottom valve on the still.
10) The operator turns on the residue pump.
11) The operator locsely touches the line until it warms.
12) The operator walks the residue line to the storage tank to check for leaks.
13) The operator watches the pin move on the gauge at the storage tank to check that the residue is being pumped to the proper tank.
14) The operator periodically checks the residue line to make sure that no one has changed the valve settings and that the line is not leaking.
15) The operator remains in the area during the pumping of the residue.
16) The residue pump changes pitch when the still goes empty. The operator then closes the bottom valve on the still and discharge valve on the pump.
17) The operator turns off the pump.
18) The operator checks that the still is empty by opening a drain valve on the bottom of the still and draining the line into a bucket. Fumes in the still will come out of the line if the still is empty.

19) The operator closes the valve on the storage tank at Location C.
20) The operator closes all valves on the lines between the storage tank and the still.
21) The operator enters the time, storage tank, and gallons pumped from the inches on the gauge on the still run sheet.

Operator - Routine procedures

h) Digging still heating coils
The procedure for digging the still heating coils is as follows:

1) The operator closes the 3 inch inlet recirculating valve to the coils.
2) The operator connects a nitrogen hose to the south end of the coil and blows any material left in the coil back into the still.
3) The operator closes the 3 inch outlet recirculating valve on the coils.
4) The operator drains any material remaining in the coil through a sample valve at the north end of the coil.
5) The operator removes the bolts on the coil flange.
6) The operator slowly pulls out the coil from the recirculating line to a support stand until he sees the end of the coil. Any excess material on the coils drains into trough on the north end of the coil.
7) The operator scrapes the coil with a curved spade until bare metal is seen.
8) The operator inserts the coil back into recirculating line and attaches the bolts to the flange.
9) The operator cleans 4 coils on #1 and #2 still and 2 coils on # 3 still.
10) The operator enters that the coils were dug on the still run sheet.

i) Distillation of Solvents in #7 still.

#7 still is a stainless steel 6000 gallon still fitted with a fractionating column and receiver. Solvents are fractionated or separated by liquids flowing down the column while vapors flow up the column from the still. Liquid flow down the column is controlled with a rotameter and pump which pumps liquid from the receiver. The liquid level in the receiver is held constant by adjusting a rotameter on the line to the storage tank.

The still runs at atmospheric pressure but is rated for full vacuum. Typical charges for the still are 5000gallons. Routine procedures for charging and still startup are identical to the other three stills running at atmospheric pressure except #7 still has no recirculating pump.

During the run the operator maintains constant reflux rate to the top of the column and varies the takeoff rate from the receiver to the storage tank to maintain a constant level in the receiver. He records pot and vapor temperatures, reflux rate, and takeoff rate every other hour.

The supervisor instructs the operator when to shutdown the still. The operator then turns off the steam to the heating jacket and the reflux pump. The operator pumps the residue to a tank designated by the supervisor.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 7-29-87 THRU 8-14-87

INSPECTOR Thomas Murphy

TASK: Unloader

EMPLOYEE: See signoff sheet attached

LOCATION: A,B, & C

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

A B C D E F G H I J K L M N O P Q R S T

□ —— NORMAL OPERATIONS

O —— EMERGENCY RESPONSE

Unloaders

Unloaders pump hazardous waste in tank wagons at unloading ramps in Location B and C. (See Figure 1) to storage tanks. They also unload drums of hazardous waste from box trailers to Location A (See Figure 1) and pump their contents to storage tanks in Location B or C.

Routine procedures are as follows:

a) Unloading tank wagons of hazardous waste.

b) Unloading box trailers of hazardous waste at Location A.

c) Pumping hazardous waste in drums at Location A to storage tanks.

d) Changing viscous liquids in drums to small blending tank at Location A.

e) Pumping liquids in small blending tank at Location A to storage tanks at Location C.

Detailed procedures for steps (a) through (e) are attached.

Unloader - Routine

a) Unloading tank wagons of hazardous waste

Hazardous waste is pumped from tank wagons at unloading ramps at Location B and C to storage tanks 1A,1B,116-126. Figures 1,2,4 show the location, pumps, piping and valves for each tank. The gauges on the storage tanks are counterweight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 1 shows the gallons of void space and corresponding inches on the straight side of each tank. The procedure for unloading tank wagons is as follows:

1) The supervisor checks the manifest papers.
2) The unloader, wearing a protective suit and emergency belt, vents the tank wagon.
3) The unloader opens the manway.
4) The unloader lowers a sample container to the bottom of the tank wagon.
5) The unloader brings the sample to the lab. When the supervisor analyzes the sample, he instructs the unloader to unload the tank wagon to a specified storage tank.
6) The unloader measures the void space inches in the storage tank to check if the tank will hold the gallons in the tank wagon (See Table 1).
7) The unloader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
8) The unloader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
9) The unloader connects the unloading hose to the tank wagon.
10) The unloader walks the line from the tank wagon to the storage tank, opening the proper valves and closing unused valves attached to the line.
11) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
12) The unloader checks the tank overfill alarm.
13) The unloader opens the valve on the storage tank.
14) The unloader turns on the unloading pump.
15) The unloader slowly opens the bottom valve on the tank wagon. He feels the 3 inch unloading hose become heavy with material.
16) The unloader looks into the top of the tank wagon to check that the material is being pumped from the tank wagon.
17) The unloader walks the line to the storage tank to check for leaks.
18) The unloader watches the pin move on the gauge at the storage tank to check that the material is being pumped to the proper tank.
19) The unloader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.

20) The unloader remains in the area during the pumping of the material.
21) The unloader watches the tank wagon go empty and then closes the bottom valve on the tank wagon.
22) The unloader turns off the pump and immediately closes the discharge valve on the pump.
23) The unloader closes the valve on the storage tank first and then closes valves on the transfer line.
24) The unloader removes the unloading hose slowly from the tank wagons.
25) The unloader disconnects the grounding device and removes the chocks.
26) The unloader signs the manifest papers with the supervisor's approval and returns them to the driver. He also informs the driver that all valves are closed and hoses are disconnected.
27) If the filter on the suction side of the transfer pump should plug during unloading, the following steps are taken:

i) The unloader closes the valve on the suction side of the filter.
ii) The unloader turns off the transfer pump.
iii) The unloader opens the nitrogen valve on the top of the filter to blow material out of the filter.
iv) The unloader closes the valve on the nitrogen line.
v) The unloader closes the valve on the outlet of the filter.
vi) The unloader opens the bleeder valve to relieve the nitrogen pressure in the filter.
vii) The unloader removes the lid and cleans the filter dumping its contents into an openhead drum
viii) The unloader replaces the lid.
ix) The unloader tests the filter gasket with nitrogen pressure.
x) The unloader opens the inlet and outlet valves on the filter.
xi) The unloader turns on the pump and continues unloading the tank wagon.

b) Unloading box trailers of hazardous waste at Location A.

Location A is a 4 foot raised concrete pad 56 x 50 covered by a sheet metal roof (See Figure 5). The procedure for unloading box trailers at Location A is as follows:

1) The supervisor checks the manifest papers.

2) The unloader chocks the trailer to prevent movement from the unloading pad.

3) The unloader, wearing the emergency belt, opens the door on the trailer.

4) If there is no strong chemical odor, the unloader rolls the drums in the box trailer to the raised pad. If there is a strong chemical odor, the unloader fits a respirator and sounds an alarm and awaits his supervisor's instructions.

5) The unloader must sample drums designated by the supervisor as follows:

   i) The drum is vented by slowly loosening the 2 inch bung.
   ii) After the bung is removed, a 1/2 inch tube about 3 feet long is lowered into the drum.
   iii) The unloader takes a sample by sealing the top of the tube, then removing it from the drum and emptying its contents into a jar.
   iv) Samples are brought to the lab and inspected by the supervisor.

6) If the samples are approved by the supervosor, the unloader signs the manifest papers. With reliable and regular customers shipments are accepted and unloaded before sampling.

7) The unloader removes the chocks after the trailer is unloaded.

c) Pumping hazardous waste in drums at Location A to storage tanks. A pump centrally located on the raised pad at Location A is used to pump the liquid in the drums to storage tanks in Location B or C. Figures 2,4 and 5 show the pump, lines, tanks, and valves. The procedure for pumping the liquid in the drums is as follows:

1) The unloader is instucted by the supervisor to pump the liquid in specified drums to a designated storage tank.
2) The unloader, wearing a protective suit and emergency belt, measures the void space in inches on the designated tank to check if the tank will hold the gallons of liquid in the drums. Tabel 1 shows the gallons and corresponding inches for each tank.
3) The unloader closes the valve on the discharge of the pump at Location A.
4) The unloader walks the line from the drum storage area to the storage tank, opening the proper valves and closing unused valves attached to the line.
5) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
6) The unloader checks the tank overfill alarm.
7) The unloader opens the valve on the storage tank.
8) The unloader slowly unlooses the bung on the first drum.
9) The unloader places the charge pipe into the first drum with the valve on the charge pipe closed.
10) The unloader opens the valve on the discharge of the pump.
11) The unloader starts the pump.
12) The unloader opens the valve on the charge pump.
13) The unloader opens the air bleeder valve on the pump until air is evacuated from the system.
14) The unloader closes the valve on the charge pipe after emptying each drum so that air will not be drawn into the system.
15) The unloader closes the valve on the charge pipe and then turns off the pump after two drums are pumped.
16) The unloader walks the line looking for leaks, and he also checks the pin to make sure that the material is being pumped to the correct tank.
17) The unloader continues to pump the specified drums.
18) The unloader closes the valve on the charge pipe after the last drum is emptied.
19) The unloader turns off the pump and immediately closes the valve on the discharge of the pump.
20) The unloader closes the valve on the storage tank first and then closes the valve on the transfer line.
21) The unloader rolls the empty drums to a trailer spotted at Location A.

22) If the filter on the suction side of the drum pump should plug during pumping the following steps are taken:

i) The unloader removes the charge pipe from the drum allowing air to enter the filter to clean the liquid from the filter body.

ii) The unloader turns off the pump immediately closes the valve on the discharge of the pump.

iii) The unloader opens the lid and cleans the filter dumping its contents into an open-head drum.

iv) The unloader replaces the lid.

v) The unloader places the charge pipe into a drum and closes the valve on the charge pipe.

vi) The unloader opens the valve on the discharge of the pump and turns the pump on.

vii) The unloader continues to pump drums.

Unloader - Routine Procedures

d) <u>Part A</u> Procedure for Emptying Drums into Box

Charging viscous liquids in drums to small blending tanks at Location A.
A 1000 gallon blending tank is used to hold liquids too viscous or thick to handle with the regular drum pump. The viscous contents of drums are dumped into a 4 x 4 box where they are pumped to the blending tank (See Figure 5). The procedure is as follows:

To assure overfill prevention, a fixxed maximum number of 16 drums is set in front of equipment before any product movement is initiated. The straining bin has a 150 gallon capacity and is emptied before adding material from another drum. The blending tank has a 1000 gallon capacity, thus the 16 drum maximum affords a safety margin. Any necessary thinning is done with the loader obseving the liquid level, through the open manway, at all time.

During the filling of the blending tank, the unloader wears protective suit and emergency belt. During emptying drums into the bin and during the emptying of the tank through the straining bin, the unloader wears a protective suit, emergency belt and a respirator.

1) The unloader rolls the drum to a position in front of the dumping ramp.
2) The unloader checks the void space in the blending tank to make sure that it can hold the contents of the drums.
3) The unloader starts the dumping box pump setting va;ves so that the liquid will be pumped to the blending tank.
4) The unloader slowly loosens the 2 inch bung and removes it from the drum.
5) The unloader slowly pushes the drum over to the horizontal position on the dumping box ramp.
6) The unloader slowly removes the 3/4 inch bung by positioning himself on the grating besides the dumping box ramp.
7) The unloader removes solid material that may collect on the dumping box screen with a shovel placing it in an open-head drum. The shovel is a special non-spark aluminum type which is dedicated to the area.
8) The unloader takes a sample of the material in the tank when it is about 2/3 full and gives it to the supervisor.
9) The unloader dumps thinning material into the dump box, if instructed by the supervisor, to thin down the viscous liquids in the blending tank.
10) The unloader rolls the empty drums to a trailer spotted at Location A.

Part B Procedure for Pulling Viscous Materials into 1000 Gallon Blending Tank (#20) with Vacuum

1) Unloader, wearing a protective suit and an emergency belt, checks the void space in blending tank to make sure that it can hold the contents of the drums to be pumped.
2) Unloader secures manway on blending tank, checks connections to vacuum pump and checks operation of float check valve.
3) Unloader applies vacuum to blending tank, allows vacuum to build in tank and checks for leaks.
4) Unloader uses 1½" charge pipe connected to charge line at bottom of blending tank, opens valve to empty drum into tank. When drum is empty valve is quickly closed.
5) For drums too viscous for 1½" charge pipe, 3" charge pipe is used on open head drums. Charge line valve is quickly closed when drum empties.
6) Unloader turns agitator on when tank is abour half full.
7) Unloader inspects material in tank when quantity of drums is pumped. Vacuum to tank is released and supply shut off. Sample is taken to supervisor for possible thinning or pumping instructions.
8) Unloader pumps thinning material into blending tank, observing level.
9) Unloader rolls empty drums to spotted trailer.

e) Pumping liquids in small blending tank at Location A to storage tanks in Location C.
Figures 4 and 5 show the location of the blending tank and storage tanks. The procedure is as follows:

1) The unloader is instructed by the supervisor to pump the liquid in the blending tank to a designated storage tank in Location C.
2) The unloader, wearing the emergency belt, measures the void space in inches on the storage tank to check that the tank will hold the gallons of liquid in the blending tank (usually 1000 gallons). Table 1 shows the gallons and corresponding inches for each tank.
3) The unloader walks the line from the small blending tank area to the storagr tank, opening the proper valves and closing unused valves attached to the line.
4) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The unloader checks the tank overfill alarm.
6) The unloader opens the valve of the storage tank.
7) The unloader turns on the pump at the blending tank.
8) The unloader opens the bottom valve on the blending tank.
    A) Unloader can also drain material frombottom of blending tank, accross screen in the 4 x 4 box (wearing a protective suit, emergency belt and a respirator) then pumps out to Location C.
9) The unloader looks into the manway of the tank to check for leaks.
11) The unloader watches the pin move on the gauge to check that the material is being pumped to the proper storage tank.
12) The unloader remains in the area during the pumping of the material.
13) The unloader, wearing a respirator, watches the blending tank to empty and then closes the bottom valve on the tank.
14) The unloader turns off the pump and immediately closes the discharge valve on the pump.
15) The unloader closes the valve on the storage tank first and then closes the valves on the transfer line.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 12-8-88

INSPECTOR THOMAS MURPHY

TASK: SOLIDS PAIL LOADER

EMPLOYEE: ROBERT VILLARS, JOHN SPUDVILLE, JOHN MIRDA, BRYAN POPA
ALVIN WHITAKER, FRANK PRICE, MICHAEL DRAIA JOHN JAZWICK
STEVEN KULAVICK.

LOCATION: DRUM UNLOADING DOCK

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

$\boxed{A}$ $\boxed{B}$ C D E $\boxed{F}$ G H $\boxed{I}$ J K L $\boxed{M}$ N O P Q R S T

□ —— NORMAL OPERATIONS

○ —— EMERGENCY RESPONSE

6.) Solids Pail Loader

Work outline for the filling of 6 gallon pails of hazardous waste flammable solid material packaged and stored on pallets of 36 pails each.

A. The following list of equipment and tools to be used.

1. Mixing Tub
2. Filling Funnel
3. Plunger
4. Aluminum Shovels
5. Brass Hammer
6. Tow Motor & Fork Extender
7. Misc. Drum Opening Tools (Bung Wrench, Speed Wrench etc.)
8. Drum Tilter
9. Barrier Tape or Rope
10. Cones or Stanchions
11. PPE Personal Protective Equipment (Respirator with R-21 Cartridges with back up R-21 cartridges available)
12. Scale
13. Lid Crimper
14. Air Signal Horn
15. Eye Wash available

B. Following list of material to be secured

1. Bag(s) of Slikwik
2. 36-6 gallon pails
3. 1-GMA Pallet 40" x 48" (Pallet to be four way entry)
4. 36 Dot (Flammable Solids) and Hazardous Waste Labels (yellow)
5. Black felt tip marker
6. Chem-Fuel's Blend Log Sheet
7. Clip board, pen and pencil
8. Full or partial full 55 gallon drums of hazardous waste solids
9. 4 oz. sample jars
10. Paper towels

C. Secure the area around the mixing tub. (Refer to area layout attached) Notify the Site Health and Safety Officer for the purpose of inspection of the area and permission to proceed.

D. Locate the equipment and materials to be handled in the proper locations. (Either inside or outside containment area) Affix the proper PPE. The drum that is to be dumped into mixing tub must first be checked with the MX-241 for any sign of a high LEL reading.

E. With the Fork Extender attached to the Towmotor and the Drum Tilter fastened to the drum, dump the contents of drum into Mixing Tub. Use brass hammer and aluminum shovel to remove all the waste material from drum.

F. Secure the empty drum.

G. The mixing tub is to be checked again with the MX-241 to assure LEL level has not risen due to agitation of the material when dumping from the drum to the mixing tub. Size solids in the mixing tub and add Slikwik if necessary, to pick up any liquid that may be present. Take a 4 oz. sample of the solids in the mixing tub and record drum number on lid.

H. Place an empty 6 gallon pail under the funnel and shovel the solids from the mixing tub unto the funnel until the pail is full. Use the plunger to compress the mixture but do not exceed the top 1" rolling hoop (if Slikwik is added to the top of the pail, this also must be compressed so as not to exceed the top rolling hoop.)

I. The outside appearance of the pail is very important. Clean the pail sides with paper toweling, if necessary, and discard the dirty paper toweling into the next pail to be filled. The clean pail can now be removed from the secured area and placed in the designated Weigh and Label Area.

J. Continue filling the pails until the mixing tub is empty. All the solids that were emptied from drum No. 1 should be now in 6 gallon pails and stored in the Weigh and Label Area.

K. PPE is to remain on in the secured area during the filling operations. Remove and secure PPE (Protective suits, rubber gloves, respirator, etc.) before moving to the Weigh and Label Area.

L. Weigh pails, crimp the lids and record pounds on the lid(6 gallon pails are 26 guage and are not to exceed 60 pounds gross). Pail lids are also to be marked with the pallet letter and pail number This information is then transferred to the Chem-Fuel "S" Blend Log Sheet along with the generator name, manifest document number and hazardous waste code.

M. DOT #4 Flammable Solid Label and Hazardous Waste Label are affixed to pail and stacked on pallet.

N. The Site Safety and Health Officer will monitor the transferring operations and make adjustments to the PPE based on his monitoring results. Each drum may require an upgrading or downgrading of the PPE level.

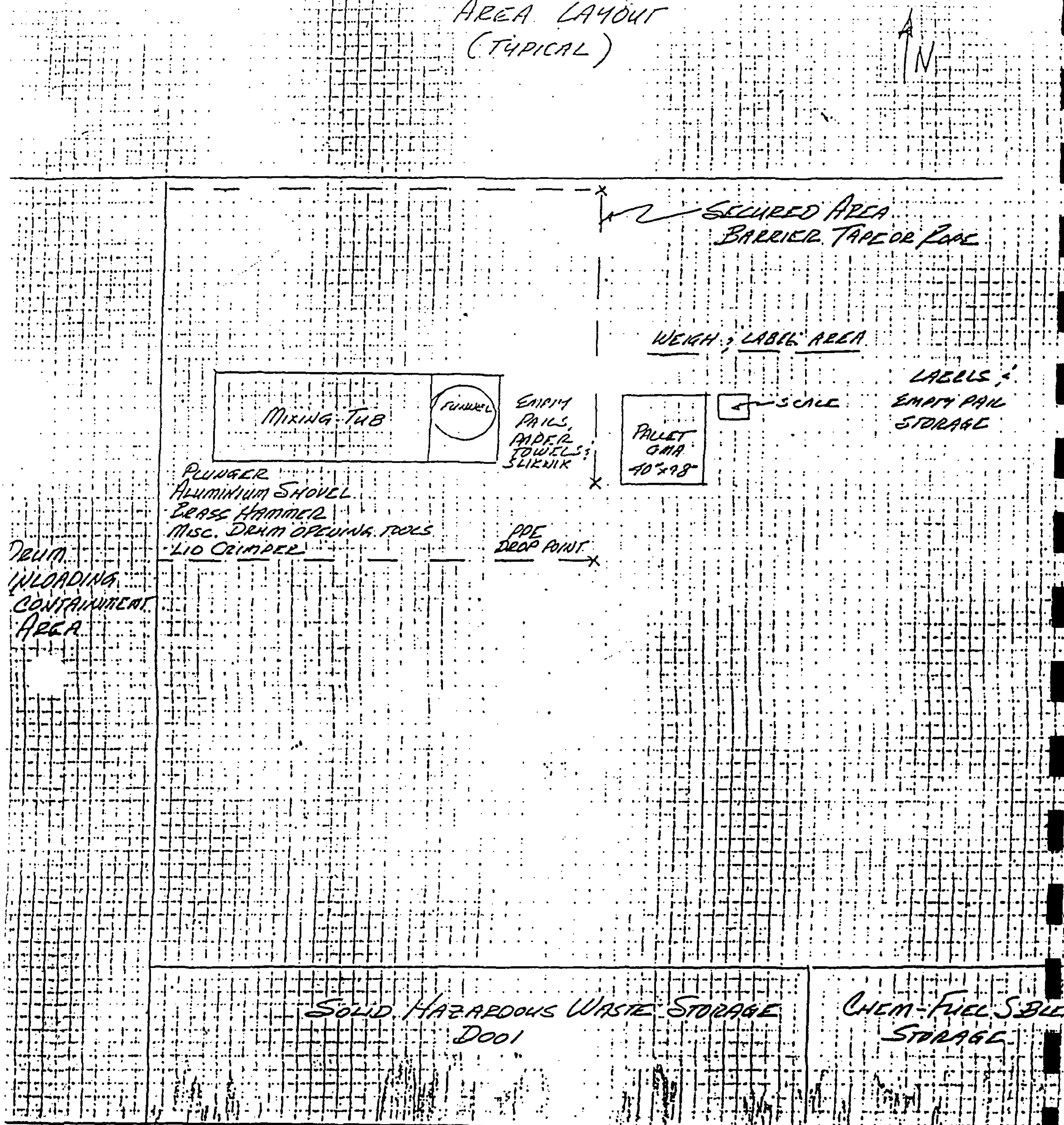
O. The Pail Filler will return to step "D"- affix the required PPE and begin operations on the next drum to be processed.

P. Shutdown and Decontamination Procedure:
   1. Scrape all the solids from the equipment used into the mixing tub.
   2. Remove the collected solids from the mixing tub and deposit them into a partially filled or empty drum of the same waste code.

3. Remove the PPE according to normal decontamination procedures. Disenfect and properly store the respirator.
4. Unsecure the area and return all equipment and unused materials.

Q. Return the empty drums to the proper storage area. Return the partially or full solid drums to the proper storage area.
Move partially or full pallets of pails to the designated storage area, return the Chem-Fuel "S" Blend Log Sheet and the samples to Production Supervisor.

CHEM-FUEL & BLEND
AREA LAYOUT
(TYPICAL)



SECTION C:

EMPLOYEE TRAINING PROGRAM

C.) Employee Training Program:

This section addresses the requirement for employee training assignments both off site and on-the-job training on the site.

As part of the RCRA requirement, ACS has training programs in place as follows:

1.) RCRA Personnel Training (Attachment C-1)
2.) Hazardous Atmosphere Entry Employee Training (Attachment C-2)
3.) Annual Fire Fighting Training (Attachment C-3) And Fire Emergency Action Plan (Attachment C-3A)
4.) Hazard Communications Program Training (Attachment C-4)
5.) General Plant Training

The extent of training to date is in excess of the initial training requirements of 24 hours for all present ACS employees engaged in hazardous waste activities. Any new employees will be trained in all programs noted above to enable each employee to perform their assigned duties and functions in a safe and healthful manner so as to not endanger themselves or other employees. The time designated and location for each program is as follows:

1.) RCRA Personnel Training
    Initial- 2 to 3 weeks- on and off site
    Annual- 2 hours- off site
2.) Hazardous Atmosphere Entry
    Initial- 1 hour- on and off site
    Annual- 1 hour- on and off site
3.) Fire Fighting Training
    Initial- 1 hour- on and off site
    Annual- 1 hour- on and off site
4.) Hazard Communications Program
    Initial- 1 hour- on and off site
    Annual- 1 hour- on and off site
5.) General Plant Training
    Initial- 3 hours- new employee on and off site
    Annual- 2 hours- new employee on and off site

ACS is in the process of establishing a Hazardous Waste Training Program which will add approximately 3 to 4 hours annually and will be conducted on and off site. The program will be implemented by 1 September, 1987 and will address the following topics:

1.) The name of the Site Safety and Health Officer and a description of his responsibilities for safety and health.
2.) Safety, health and other hazards present on site.
3.) Personal hygiene and signs and symptoms of chemical exposure and heat stress that indicates potential medical emergencies.

4.) Use of personal protective equipment which is required or assigned to perform designated job descriptions or in response to an emergency situation.
5.) Work practices which will help minimize the chances of employee injury during the performance of the designated jobs.
6.) Safe operating technics when utilizing the equipment assigned to each job description.
7.) Medical surveillance requirements which include recognizing the symptoms which might indicate over exposure to hazardous conditions.
8.) Decontamination procedures for normal and emergency operations.
9.) Review Emergency Response to minor spills, major spills, fire, or explosions involving hazardous waste. Evacuation and Contingency Plan procedures will also be discussed.

Each employee engaged in hazardous waste activities will have an Annual Training Schedule (Attachment C-5) on file which will certify the attendance for each of the above programs. The annual training for all operators engaged in hazardous waste activities will be a minimum of 8 hours.

RCRA

Personnel Training

Outline of the Training Program

(1) Facility personnel must successfully complete an instructional program and on-the-job training before assuming responsibilities for handling hazardous wastes.

(2) This program is directed by the emergency coordinator.

(3) As part of the instructional training program, the following items are explained to each employee by the emergency coordinator:

- (i) Safety precautions;
- (ii) Job descriptions outlining the methods for handling hazardous wastes where applicable;
- (iii) Emergency equipment and its operation;
- (iv) Monitoring equipment and its operation where applicable;
- (v) Communication system;
- (vi) Response to spills;
- (vii) Response to fires or explosions; and
- (viii) State of readiness or shutdown of operations.
- (ix) Evacuation

As part of the on-the-job training each employee is required to perform duties on the job where applicable as outlined in job descriptions under the direct supervision of the emergency coordinator.

New plant personnel are indoctrinated in the instructional program by the emergency coordinator. In addition there is a training period (usually 2-3 weeks) where new personnel work directly with experienced personnel to acquire skills to handle the hazardous waste properly. At the end of that period the newly trained employee is required to perform duties on the job under the direct supervision of the emergency coordinator as outlined in the job descriptions.

Personnel handling hazardous wastes are required annually to read sections i through ix that apply to their designated jobs. The training director (emergency coordinator) then observes the employee performing the routine procedures. A demonstration of fire fighting equipment is also given annually.

Job Title/Job Descriptions

Job titles and descriptions related to hazardous wastes are as follow:

1.) Operator

Operators operate the reclaim facility. They distill solvents from hazardous wastes in Location B (See Figure 1) in vessels (stills) using steam and vacuum. The distillate solvents are stored in the reclaim product tank farm. The residues from the stills are pumped to the waste fuel tank farm at Location C (See Figure 1).

2.) Unloaders

Unloaders pump hazardous waste in tank wagons at unloading ramps in Location B and C. (See Figure 1) to storage tanks. They also unload drums of hazardous waste from box trailers to Location A (See Figure 1) and pump their contents to storage tanks in Location B or C.

3.) Loaders

Loaders pump hazardous waste in storage tanks at Location C to a tank wagon in the loading area (See Figure 4).

4.) Tractor driver

Some shipments of drums of hazardous waste arrives in trailers which are not the same height as the raised pad at Location A. The tractor driver unloads the drums from the trailer and halls them to the raised pad.

5.) Laborer

Laborers assist tractor drivers and unloaders in unloading box trailers and pumping drums. Their efforts are regularly directed by supervisors, unloaders or tractor drivers. They also dig solids which collect in the storage tanks and stills during processing.

6.) Solids Pail Loader

Solids Pail Loaders fill flammable solid hazardous waste into 6 gallon pails. The operations are conducted in Location A.

Training Content, Frequency, and Techniques

(1) Facility personnel must successfully complete an instructional program and on-the-job training before assuming responsibilities for handling hazardous wastes.

(2) This program is directed by the emergency coordinator.

(3) As part of the instructional training program, the following items are explained to each employee by the emergency coordinator:

(i) Safety precautions;
(ii) Job descriptions outlining the methods for handling hazardous wastes where applicable;
(iii) Emergency equipment and its operation
(iv) Monitoring equipment and its operation where applicable;
(v) Communications system;
(vi) Response to spills;
(vii) Response to fires or explosions; and
(viii) State of readiness or shutdown of operations.
(ix) Evacuation

As part of the on-the-job training each employee is required to perform duties on the job where applicable as outlined in job descriptions under the direct supervision of the emergency coordinator.

New plant personnel are indoctrinated in the instructional program by the emergency coordinator. In addition there is a training period (usually 2-3 weeks) where new personnel work directly with experienced personnel to acquire skills to handle the hazardous waste properly. At the end of that period the job under the direct supervision of the emergency coordinator as outlined in the job descriptions.

Personnel handling hazardous wastes are required annually to read sections i through ix that apply to their designated jobs. The training director (emergency coordinator then observes the employee performing the routine procedures. A demonstration of fire fighting equipment is also given annually.

(i) Safety Precautions

1.) No smoking is permitted at the facility

2.) Safety equipment such as hard hats, safety glasses, and gloves must be worn at all times except in smoking areas. See Figure 6. Workers must wear protective suits when processing drums to the small blending tank at Location A.

Workers must wear respirators when draining material from the small blending tank across the screen in the 4 x 4 box. Workers must wear a breathing apparatus and a body suit when entering a tank containing vapors of hazardous waste.

3.) Workers at the facility must not contact the hazardous waste. If he does, clothing must be changed and the contact area washed thoroughly.

4.) All possible ignition sources, such as matches, reciprocating engines, open flames, frictional sources, and sparks must be kept away from exposed wastes if any. Normally wastes are contained in drums or tanks.

(ii) Job descriptions Outlining the Methods for Handling Hazardous Wastes

Job titles related to hazardous wastes are as follows:

1) Operator

2) Unloader

3) Loader

4) Tractor driver

5) Laborer

6) Solids Pail Loader

Written job descriptions for each position are as follows:

1) Operator

Operators operate the reclaim facility. They distill solvents from hazardous wastes in Location B (See Figure 1) in vessels (stills) using steam and vacuum. The distillate solvents are stored in the reclaim product tank farm. The residues from the stills are pumped to the waste-fuel tank farm at Location C (See Figure 1).

Routine Procedures are as follows:

a) Charge amounts of 4000 and 2300 gallons.

b) Pumping hazardous waste from tanks in Location B to the still.

c) Still startup.

d) Distillation of solvents during run.

e) Sampling of residue to shutdown still.

f) Shutdown of still.

g) Pumping residue to Location C.

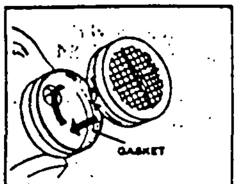
h) Digging still heating coils.

i) Distillation of solvents in #7 still.

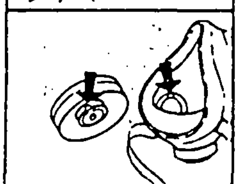
Detailed procedures for steps (a) through (i) are attached.

INSTRUCTIONS FOR USE

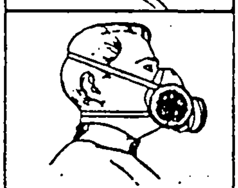
TAKE CARE OF YOUR RESPIRATOR AND YOUR HEALTH



1. Remove respirator, cartridges and filters from plastic bags. Check to see that gasket is in cartridge holder before screwing in cartridges. Insert filter into retainer caps and snap onto cartridge holder or cartridges.



2. The cartridge holders are keyed to assure their correct positioning and maintain the proper balance of the device. Make sure they are properly positioned and seated.

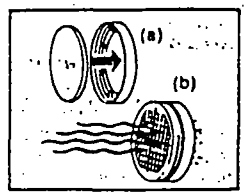


3. Place respirator on face with narrow end over nose and bottom under chin. First attach top headband around crown of head and then bottom around neck. Adjust headbands until a tight but comfortable fit is obtained.

OR

Place respirator on face with narrow end over nose and bottom under chin. Place headstraps as shown. Tighten headstraps by pulling firmly on loops on both sides of mask. Loosen headstrap by pushing headband clip away from face and gently pulling headstrap. Adjust headbands until a tight but comfortable fit is obtained.

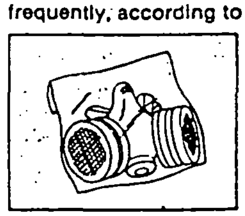
4. TEST FOR TIGHTNESS: Place the palm of the hand or thumb over the valve guard and press lightly. Exhale to cause a slight pressure inside facepiece. If no air escapes, respirator is properly fitted. If air escapes, readjust respirator and test again.



5. FILTERS (a) REPLACE when breathing becomes difficult INSERT new filters INTO retainer cap and replace cap. Generally the filter discs should be changed after eight hours of dusty exposure. (b) CHEMICAL CARTRIDGES should be replaced when the senses detect ANY abnormal condition.

6. MAINTENANCE: The respirator facepiece should be cleaned daily to prevent skin irritation and for general sanitary purposes. First remove filters and cartridges. Then the facepiece may be washed with a hand brush using a good detergent in warm water, rinsing, and air drying in a clean place. For general cleaning-disinfecting, use Willson Santa-Sol® detergent-germicide solution. Other compounds considered to be suitable for disinfecting are: (1) a hypochlorite solution (50 parts per million of chlorine; immersion time, 2 min.) (2) an aqueous solution of iodine (50 ppm iodine, immersion time, 2 min.) (3) a quaternary ammonium solution (200 ppm quaternary ammonium compounds in water with less than 500 ppm total hardness). RINSE IN CLEAN WARM WATER AND AIR DRY. Inspect respirator daily for worn or faulty parts and replace these at once. In order for this respirator to maintain its approval, proper parts supplied by the manufacturer must be used.

7. FOR YOUR PROTECTION the DUST FILTERS and CHEMICAL CARTRIDGES must be assembled tightly, and changed frequently, according to exposure.



8. KEEP RESPIRATOR CLEAN when not in use. Store in container provided. Replace worn or faulty parts immediately, and order by part number.

9. Many chemicals can be absorbed through the skin. Wear protective clothing when necessary.

WILLSON

WARNING

1. THIS DEVICE DOES <u>NOT</u> SUPPLY OXYGEN.
2. USE ONLY IN ADEQUATELY VENTILATED AREAS CONTAINING SUFFICIENT OXYGEN TO SUPPORT LIFE.
3. DO <u>NOT</u> USE WHERE CONCENTRATIONS OF CONTAMINANTS ARE IMMEDIATELY DANGEROUS TO LIFE.
4. LEAVE AREA IMMEDIATELY IF:
   A) BREATHING BECOMES DIFFICULT
   B) DIZZINESS OR OTHER DISTRESS OCCURS
   C) YOU TASTE OR SMELL CONTAMINANT
5. USE STRICTLY IN ACCORDANCE WITH INSTRUCTIONS, LABELS, AND LIMITATIONS PERTAINING TO THIS DEVICE.
6. NEVER ALTER OR MODIFY THIS DEVICE.

f) Shutdown of still.

g) Pumping residue to Location C.

h) Digging still heating coils.

i) Distillation of solvents in #7 still.

Detailed procedures for ste ps (a) through (i) are attached.

Operator - Routine procedures

a) The charge amounts are 4000 and 2300 gallons. Below is a list of the storage tanks and the inches on the straight side of each tank which corresponds to the designed charge.

TANK	4000 GAL.	2300 GAL.	GAL/INCH
116-119	57 inches	33 inches	70.5
120	100 "	58 "	40.
121-122	82 "	47 "	48.5
123-126	82 "	47 "	48.5
1A-1B		111"	20.7

The gauges on the tanks are counterweight float type. When the counter weight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty.

Figure 2 shows the location of the storage tanks.

b) Pumping hazardous waste from tanks in Location B to the still. Charges for the stills are contained in tanks 1A, 1B, 116-119, 120-126. Figures 2 and 3 are detailed drawings showing the tanks, piping, and valves. The procedure for charging a still from the storage tank is as follows:

1) The supervisor specifies the material to be charged; the amount, and the storage tank number. This information is written on a daily run sheet for each still.
2) The operator determines the inches corresponding to the specified gallons from the tank chart in part (a).
3) The operator, wearing an emergency belt (personnel alarm, eyewash and respirator), checks that the still is empty by opening the atmospheric vent valve on the still and then opening a drain valve on the bottom of the still. He drains the line into a bucket.
4) The operator turns on the still recirculating pump.
5) The operator opens valves on the transfer line between the storage tank and the still. He closes unused valves attached to the transfer line. The last valve to be opened is the storage tank valve.
6) The operator sets the pin on the 0 inches mark on the tank.
7) The operator opens the valve on the storage tank.
8) The operator turns on the transfer pump to pump material to the still.
9) The operator inspects the lines to check that the line has no leaks.
10) The operator watches the pin move on the storage tank to make sure that the material is being pumped from the proper tank.
11) The operator periodically checks the line to make sure it is not leaking.
12) The operator remains in the area while pumping to the still.
13) The operator closes the storage tank valve when the pin reaches the proper inches reading on the gauge.
14) The operator turns off the pump.
15) The operator closes all valves on line between the storage tank and the still.
16) The operator enters the time, storage tank number, still number, and gallons charged on the standard still run sheet.

c) Still startup
Stills are run at atmospheric or vacuum conditions. At the atmospheric condition the startup procedure is as follows:

1) The operator checks that the atmospheric vent valve on the still is open.
2) The operator sets the vent float in case the still later bumps during heatup. This device prevents the contents of the still from foaming out of the still during the run.
3) The operator closes the valve on the vacuum line to the still.
4) The operator records the time and temperature of the pot, vapor, and the cooling water on the condenser outlet.
5) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig usually. Runs of crude methylene chloride, perchlor, and trichlor require initial pressure settings of 30 psig.
6) The operator monitors the still pot temperature. At 120-150F solvents usually begin to vaporize from crude in the still. The vapors pass to the condensor where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still.
7) The operator turns on the product pump when the distilled solvent first appears in the sight glass. The pump, which can pump ½ to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.
8) The operator records the time and temperature when the still starts to distill.

At the vacuum condition the startup procedure is as follows:

1) The operator closes the atmospheric vent valve on the still.
2) The operator opens the valve on the vacuum line to the still.
3) The operator sets the vacuum controls on 30(no vacuum).
4) The operator turns on the vacuum pump and sets the seal water flow at 5 gallons per minute or 5 psig on gauge.
5) The operator slowly adjusts the vacuum controller to a setting of 15.
6) The operator records the time and temperatures of the pot, vapor, and cooling water on the condenser outlet.
7) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig.
8) The operator monitors the still pot temperature. At 110-130F solvents usually begin to vaporize from the crude in the still. The vapors pass to the condenser where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still. If the material in the sight glass is dirty, the operator turns off steam to the heating coil and sets the vacuum controller to 30. He opens the atmospheric vent on the still after hooking up the nitrogen purge system to the vent.

A check valve on the nitrogen purge system will clatter when the atmospheric condition is reached. The operator removes the nitrogen purge system and goes back to step (1) and starts over again. Any dirty material in the lines is drummed.

9) The operator turns on the product pump when clean distilled solvent first appears in the sight glass. The pump, which can pump ½ to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.

10) The operator records the time and temperature when the still starts to distill.

Operator - Routine procedures

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d) Distillation of solvents during run.

During the run the operator watches the sight glass and vacuum indicator. Every other hour the time, vacuum, and temperatures of the vapor, pot, and condenser outlet water are entered on the run sheet. When a receiver almost fills, the operator takes a sample to check for color before pumping the liquid in the receiver. He then pumps it to a storage tank specified by the supervisor. The operator enters the time, storage tank gauge readings, before and after pumping, and the corresponding gallons. The gallons are then subtracted from the total initial charge to the still. The remaining gallons in the still are entered on the still run sheet.

Operator - Routine procedures

e) Sampling of residue to shutdown still.
As solvent is distilled the residue is concentrated and its viscosity or thickness increases. The operator takes a 4 ounce sample from a sample valve on the still coil when approximately 40-50% of the charge volume is distilled. When the sample cools and its consistency is like molasses, the still is shutdown.

f) Shutdown of still
The shutdown procedure for a still under vacuum conditions is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the vacuum pump and seal water.
4) The operator attaches the nitrogen purge system to the atmospheric still vent line.
5) The operator opens the still vent valve.
6) The operator opens the nitrogen valve and sets the rotameter at 30 to bring the still back to atmospheric pressure. A check valve on the purge system clatters when atmospheric pressure is reached.
7) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
8) The operator leaves the still recirculating pump on during and after the shutdown.

The shutdown procedure for a still at the atmospheric condition is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
4) The operator leaves the still recirculating pump on during and after the shutdown.

Operator - Routine Procedures

g) Pumping residue to Location C.
Residues are pumped from the stills with a Worthington pump to storage tanks at Location C. Firure 3 shows the stills and pump, and Figure 4 shows the storage tanks at Location C. The procedure for pumping the residue is as follows:

1) The supervisor specifies the proper storage tank at Location C. This information is written on a daily run sheet for each still.
2) The operator determines the inches corresponding to the gallons of residue in the still for the specified storage tank. See table below.

Tanks - 202,203 204,205,206 Gallons Residue	Inches	Tanks 210 211,212 Gallons Residue
540	10"	700
810	15"	1050
1080	20"	1400
1350	25"	1750
1620	30"	2100
1890	35"	2450
2160	40"	2800
2430	45"	3150
2700	50"	3500

3) The operator then measures the void space in inches in the storage tank at Location C to check if the tank will hold the gallons of residue figured in tank inches.
4) The operator sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The operator checks the tank overfill alarm.
6) The operator opens the valve on the storage tank.
7) The operator walks the line from the storage tank to the residue pump opening the proper valves and closing unused valves attached to the line.
8) The operator turns on the automatic greaser line to the packing gland of the residue pump.
9) The operator opens the bottom valve on the still.
10) The operator turns on the residue pump.
11) The operator loosely touches the line until it warms.
12) The operator walks the residue line to the storage tank to check for leaks.
13) The operator watches the pin move on the gauge at the storage tank to check that the residue is being pumped to the proper tank.
14) The operator periodically checks the residue line to make sure that no one has changed the valve settings and that the line is not leaking.
15) The operator remains in the area during the pumping of the residue.
16) The residue pump changes pitch when the still goes empty. The operator then closes the bottom valve on the still and discharge valve on the pump.
17) The operator turns off the pump.
18) The operator checks that the still is empty by opening a drain valve on the bottom of the still and draining the line into a bucket. Fumes in the still will come out of the line if the still is empty.

19) The operator closes the valve on the storage tank at Location C.
20) The operator closes all valves on the lines between the storage tank and the still.
21) The operator enters the time, storage tank, and gallons pumped from the inches on the gauge on the still run sheet.

h) Digging still heating coils

The procedure for digging the still heating coils is as follows:

1) The operator closes the 3 inch inlet recirculating valve to the coils.
2) The operator connects a nitrogen hose to the south end of the coil and blows any material left in the coil back into the still.
3) The operator closes the 3 inch outlet recirculating valve on the coils.
4) The operator drains any material remaining in the coil through a sample valve at the north end of the coil.
5) The operator removes the bolts on the coil flange.
6) The operator slowly pulls out the coil from the recirculating line to a support stand until he sees the end of the coil. Any excess material on the coils drains into trough on the north end of the coil.
7) The operator scrapes the coil with a curved spade until bare metal is seen.
8) The operator inserts the coil back into recirculating line and attaches the bolts to the flange.
9) The operator cleans 4 coils on #1 and #2 still and 2 coils on # 3 still.
10) The operator enters that the coils were dug on the still run sheet.

i) Distillation of Solvents in #7 still.

#7 still is a stainless steel 6000 gallon still fitted with a fractionating column and receiver. Solvents are fractionated or separated by liquids flowing down the column while vapors flow up the column from the still. Liquid flow down the column is controlled with a rotameter and pump which pumps liquid from the receiver. The liquid level in the receiver is held constant by adjusting a rotameter on the line to the storage tank.

The still runs at atmospheric pressure but is rated for full vacuum. Typical charges for the still are 5000gallons. Routine procedures for charging and still startup are identical to the other three stills running at atmospheric pressure except #7 still has no recirculating pump.

During the run the operator maintains constant reflux rate to the top of the column and varies the takeoff rate from the receiver to the storage tank to maintain a constant level in the receiver. He records pot and vapor temperatures, reflux rate, and takeoff rate every other hour.

The supervisor instructs the operator when to shutdown the still. The operator then turns off the steam to the heating jacket and the reflux pump. The operator pumps the residue to a tank designated by the supervisor.

2) Unloaders

Unloaders pump hazardous waste in tank wagons at unloading ramps in Location B and C. (See Figure 1) to storage tanks. They also unload drums of hazardous waste from box trailers to Location A (See Figure 1) and pump their contents to storage tanks in Location B or C.

Routine procedures are as follows:

a) Unloading tank wagons of hazardous waste.

b) Unloading box trailers of hazardous waste at Location A.

c) Pumping hazardous waste in drums at Location A to storage tanks.

d) Changing viscous liquids in drums to small blending tank at Location A.

e) Pumping liquids in small blending tank at Location A to storage tanks at Location C.

Detailed procedures for steps (a) through (e) are attached.

Unloader - Routine

a) Unloading tank wagons of hazardous waste

Hazardous waste is pumped from tank wagons at unloading ramps at Location B and C to storage tanks 1A,1B,116-126. Figures 1,2,4 show the location, pumps, piping and valves for each tank. The gauges on the storage tanks are counter-weight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 1 shows the gallons of void space and corresponding inches on the straight side of each tank. The procedure for unloading tank wagons is as follows:

1) The supervisor checks the manifest papers.
2) The unloader, wearing a protective suit and emergency belt, vents the tank wagon.
3) The unloader opens the manway.
4) The unloader lowers a sample container to the bottom of the tank wagon.
5) The unloader brings the sample to the lab. When the supervisor analyzes the sample, he instructs the unloader to unload the tank wagon to a specified storage tank.
6) The unloader measures the void space inches in the storage tank to check if the tank will hold the gallons in the tank wagon (See Table 1).
7) The unloader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
8) The unloader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
9) The unloader connects the unloading hose to the tank wagon.
10) The unloader walks the line from the tank wagon to the storage tank, opening the proper valves and closing unused valves attached to the line.
11) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
12) The unloader checks the tank overfill alarm.
13) The unloader opens the valve on the storage tank.
14) The unloader turns on the unloading pump.
15) The unloader slowly opens the bottom valve on the tank wagon. He feels the 3 inch unloading hose become heavy with material.
16) The unloader looks into the top of the tank wagon to check that the material is being pumped from the tank wagon.
17) The unloader walks the line to the storage tank to check for leaks.
18) The unloader watches the pin move on the gauge at the storage tank to check that the material is being pumped to the proper tank.
19) The unloader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.

20) The unloader remains in the area during the pumping of the material.
21) The unloader watches the tank wagon go empty and then closes the bottom valve on the tank wagon.
22) The unloader turns off the pump and immediately closes the discharge valve on the pump.
23) The unloader closes the valve on the storage tank first and then closes valves on the transfer line.
24) The unloader removes the unloading hose slowly from the tank wagons.
25) The unloader disconnects the grounding device and removes the chocks.
26) The unloader signs the manifest papers with the supervisor's approval and returns them to the driver. He also informs the driver that all valves are closed and hoses are disconnected.
27) If the filter on the suction side of the transfer pump should plug during unloading, the following steps are taken:

i) The unloader closes the valve on the suction side of the filter.
ii) The unloader turns off the transfer pump.
iii) The unloader opens the nitrogen valve on the top of the filter to blow material out of the filter.
iv) The unloader closes the valve on the nitrogen line.
v) The unloader closes the valve on the outlet of the filter.
vi) The unloader opens the bleeder valve to relieve the nitrogen pressure in the filter.
vii) The unloader removes the lid and cleans the filter dumping its contents into an openhead drum
viii) The unloader replaces the lid.
ix) The unloader tests the filter gasket with nitrogen pressure.
x) The unloader opens the inlet and outlet valves on the filter.
xi) The unloader turns on the pump and continues unloading the tank wagon.

TABLE 1

GALLONS IN VOID SPACE

Inches	1A,1B	120	121-126	202-206	210-212
10	200	400	480	540	700
20	400	800	960	1080	1400
30	600	1200	1440	1620	2100
40	800	1600	1920	2160	2800
50	1000	2000	2400	2700	3500
60	1200	2400	2880	3240	4200
70	1400	2800	3360	3780	4900
80	1600	3200	3840	4320	5600
90	1800	3600	4320	4860	6300
100	2000	4000	4800	5400	7000
110	2200	4400	5280	5940	7700
120	2400	4800	5760	6480	8400
130	2600	5200	6240	7020	9100
140	2800	5600	6720	7560	9800

Unloader - Routine procedures

b) Unloading box trailers of hazardous waste at Location A.

Location A is a 4 foot raised concrete pad 56 x 50 covered by a sheet metal roof (See Figure 5). The procedure for unloading box trailers at Location A is as follows:

1) The supervisor checks the manifest papers.

2) The unloader chocks the trailer to prevent movement from the unloading pad.

3) The unloader, wearing the emergency belt, opens the door on the trailer.

4) If there is no strong chemical odor, the unloader rolls the drums in the box trailer to the raised pad. If there is a strong chemical odor, the unloader fits a respirator and sounds an alarm and awaits his supervisor's instructions.

5) The unloader must sample drums designated by the supervisor as follows:

   i) The drum is vented by slowly loosening the 2 inch bung.
   ii) After the bung is removed, a 1/2 inch tube about 3 feet long is lowered into the drum.
   iii) The unloader takes a sample by sealing the top of the tube, then removing it from the drum and emptying its contents into a jar.
   iv) Samples are brought to the lab and inspected by the supervisor.

6) If the samples are approved by the supervosor, the unloader signs the manifest papers. With reliable and regular customers shipments are accepted and unloaded before sampling.

7) The unloader removes the chocks after the trailer is unloaded.

Unloader - Routine procedures

c) Pumping hazardous waste in drums at Location A to storage tanks. A pump centrally located on the raised pad at Location A is used to pump the liquid in the drums to storage tanks in Location B or C. Figures 2,4 and 5 show the pump, lines, tanks, and valves. The procedure for pumping the liquid in the drums is as follows:

1) The unloader is instucted by the supervisor to pump the liquid in specified drums to a designated storage tank.
2) The unloader, wearing a protective suit and emergency belt, measures the void space in inches on the designated tank to check if the tank will hold the gallons of liquid in the drums. Tabel 1 shows the gallons and corresponding inches for each tank.
3) The unloader closes the valve on the discharge of the pump at Location A.
4) The unloader walks the line from the drum storage area to the storage tank, opening the proper valves and closing unused valves attached to the line.
5) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
6) The unloader checks the tank overfill alarm.
7) The unloader opens the valve on the storage tank.
8) The unloader slowly unlooses the bung on the first drum.
9) The unloader places the charge pipe into the first drum with the valve on the charge pipe closed.
10) The unloader opens the valve on the discharge of the pump.
11) The unloader starts the pump.
12) The unloader opens the valve on the charge pump.
13) The unloader opens the air bleeder valve on the pump until air is evacuated from the system.
14) The unloader closes the valve on the charge pipe after emptying each drum so that air will not be drawn into the system.
15) The unloader closes the valve on the charge pipe and then turns off the pump after two drums are pumped.
16) The unloader walks the line looking for leaks, and he also checks the pin to make sure that the material is being pumped to the correct tank.
17) The unloader continues to pump the specified drums.
18) The unloader closes the valve on the charge pipe after the last drum is emptied.
19) The unloader turns off the pump and immediately closes the valve on the discharge of the pump.
20) The unloader closes the valve on the storage tank first and then closes the valve on the transfer line.
21) The unloader rolls the empty drums to a trailer spotted at Location A.

22) If the filter on the suction side of the drum pump should plug during pumping the following steps are taken:

i) The unloader removes the charge pipe from the drum allowing air to enter the filter to clean the liquid from the filter body.

ii) The unloader turns off the pump immediately closes the valve on the discharge of the pump.

iii) The unloader opens the lid and cleans the filter dumping its contents into an open-head drum.

iv) The unloader replaces the lid.

v) The unloader places the charge pipe into a drum and closes the valve on the charge pipe.

vi) The unloader opens the valve on the discharge of the pump and turns the pump on.

vii) The unloader continues to pump drums.

Unloader - Routine Procedures

d) <u>Part A</u> Procedure for Emptying Drums into Box

Charging viscous liquids in drums to small blending tanks at Location A.
A 1000 gallon blending tank is used to hold liquids too viscous or thick to handle with the regular drum pump. The viscous contents of drums are dumped into a 4 x 4 box where they are pumped to the blending tank (See Figure 5). The procedure is as follows:

To assure overfill prevention, a fixxed maximum number of 16 drums is set in front of equipment before any product movement is initiated. The straining bin has a 150 gallon capacity and is emptied before adding material from another drum. The blending tank has a 1000 gallon capacity, thus the 16 drum maximum affords a safety margin. Any necessary thinning is done with the loader obseving the liquid level, through the open manway, at all time.

During the filling of the blending tank, the unloader wears protective suit and emergency belt. During emptying drums into the bin and during the emptying of the tank through the straining bin, the unloader wears a protective suit, emergency belt and a respirator.

1) The unloader rolls the drum to a position in front of the dumping ramp.
2) The unloader checks the void space in the blending tank to make sure that it can hold the contents of the drums.
3) The unloader starts the dumping box pump setting va;ves so that the liquid will be pumped to the blending tank.
4) The unloader slowly loosens the 2 inch bung and removes it from the drum.
5) The unloader slowly pushes the drum over to the horizontal position on the dumping box ramp.
6) The unloader slowly removes the 3/4 inch bung by positioning himself on the grating besides the dumping box ramp.
7) The unloader removes solid material that may collect on the dumping box screen with a shovel placing it in an open-head drum. The shovel is a special non-spark aluminum type which is dedicated to the area.
8) The unloader takes a sample of the material in the tank when it is about 2/3 full and gives it to the supervisor.
9) The unloader dumps thinning material into the dump box, if instructed by the supervisor, to thin down the viscous liquids in the blending tank.
10) The unloader rolls the empty drums to a trailer spotted at Location A.

Part B Procedure for Pulling Viscous Materials into 1000 Gallon Blending Tank (#20) with Vacuum

1) Unloader, wearing a protective suit and an emergency belt, checks the void space in blending tank to make sure that it can hold the contents of the drums to be pumped.
2) Unloader secures manway on blending tank, checks connections to vacuum pump and checks operation of float check valve.
3) Unloader applies vacuum to blending tank, allows vacuum to build in tank and checks for leaks.
4) Unloader uses 1½" charge pipe connected to charge line at bottom of blending tank, opens valve to empty drum into tank. When drum is empty valve is quickly closed.
5) For drums too viscous for 1½" charge pipe, 3" charge pipe is used on open head drums. Charge line valve is quickly closed when drum empties.
6) Unloader turns agitator on when tank is abour half full.
7) Unloader inspects material in tank when quantity of drums is pumped. Vacuum to tank is released and supply shut off. Sample is taken to supervisor for possible thinning or pumping instructions.
8) Unloader pumps thinning material into blending tank, observing level.
9) Unloader rolls empty drums to spotted trailer.

e) *Pumping liquids in small blending tank at Location A to storage tanks in Location C.*
Figures 4 and 5 show the location of the blending tank and storage tanks. The procedure is as follows:

1) The unloader is instructed by the supervisor to pump the liquid in the blending tank to a designated storage tank in Location C.
2) The unloader, wearing the emergency belt, measures the void space in inches on the storage tank to check that the tank will hold the gallons of liquid in the blending tank (usually 1000 gallons). Table 1 shows the gallons and corresponding inches for each tank.
3) The unloader walks the line from the small blending tank area to the storagr tank, opening the proper valves and closing unused valves attached to the line.
4) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The unloader checks the tank overfill alarm.
6) The unloader opens the valve of the storage tank.
7) The unloader turns on the pump at the blending tank.
8) The unloader opens the bottom valve on the blending tank.
    A) Unloader can also drain material frombottom of blending tank, accross screen in the 4 x 4 box (wearing a protective suit, emergency belt and a respirator) then pumps out to Location C.
9) The unloader looks into the manway of the tank to check for leaks.
11) The unloader watches the pin move on the gauge to check that the material is being pumped to the proper storage tank.
12) The unloader remains in the area during the pumping of the material.
13) The unloader, wearing a respirator, watches the blending tank to empty and then closes the bottom valve on the tank.
14) The unloader turns off the pump and immediately closes the discharge valve on the pump.
15) The unloader closes the valve on the storage tank first and then closes the valves on the transfer line.

Loaders

Loaders pump hazardous waste in storage tanks at Location C to a tank wagon in the loading area (See Figure 4).

Routine procedures are as follows:

a) Loading tank wagons with hazardous waste.

Hazardous waste is pumped from storage tanks in Location C to a tank wagon in the loading area. Figure 4 shows the location, pump, piping and valves for each tank. The gauges on the storage tanks are counterweight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 2 shows the gallons of material and corresponding inches on the straight side of each tank. The procedure for loading tank wagons is as follows:

1) The supervisor instructs the loader to load the tank wagon with a specified amount from a specified storage tank.
2) The loader, wearing a protective suit and a emergency belt, vents the tank wagon.
3) The loader opens the manway on the tank wagon.
4) The loader inspects the tank wagon to make sure that it is empty.
5) The loader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
6) The loader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
7) The loader connects the loading hose to the tank wagon.
8) The loader walks the line from the tank wagon to the storage, opening the proper valves and closing unused valves attached to the line.
9) The loader sets the pin on the weld mark on the tank approximately 7 feet off the ground.
10) The loader opens the valve on the storage tank.
11) The loader turns on the loading pump.
12) The loader walks the line from the storage tank to the tank wagon to check for leaks.
13) The loader looks into the top of the wagon to check that material is being pumped to the tank wagon.
14) The loader watches the pin move on the gauge at the tank to check that material is being pumped to the proper tank.
15) The loader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.
16) The loader remains in the area during the pumping of the material.
17) The loader checks the tank wagon level periodically to make sure that the specified amount will fit into the tank wagon.
18) The loader closes the valve on the storage tanks when the pin reaches the specified mark.

19) The loader turns off the loading pump.
20) The loader closes all valves between the storage tank and the tank wagon except for the valve on the tank wagon.
21) The loader blows the loading hose clear with nitrogen to remove any liquid in the line.
22) The loader closes the valve on the tank wagon.
23) The loader opens the bleeder valve on the line to relieve the nitrogen pressure.
24) The loader disconnects the loading hose.
25) The loader samples the tank wagon from the manway.
26) The loader closes the manway and vent valve.
27) The loader fills out the tank wagon manifest with the supervisor's approval.
28) The loader has the driver sign the manifest.
29) The loader retains the generator copy and returns it to the supervisor.
30) The loader disconnects the grounding device and removes the chocks.
31) The loader informs the driver that all valves are closed and hoses are disconnected.
32) If the filter on the loading pump should plug during loading, the following steps are taken:

    i) The loader closes the valve on the suction side of the filter.
    ii) The loader turns off the loading pump.
    iii) The loader opens the nitrogen valve on top of the filter to blow material out of the filter.
    iv) The loader closes the valve on the nitrogen line.
    v) The loader closes the valve on the outlet of the filter.
    vi) The loader opens the bleeder valve on the filter to relieve the pressure in the filter.
    vii) The loader removes the lid and cleans the filter by dumping its contents into an openhead drum.
    viii) The loader replaces the lid.
    ix) The loader tests the filter gasket with nitrogen.
    x) The loader opens the inlet and outlet valves on the filter.
    xi) The loader turns on the pump and continues loading the tank wagon.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 7-29-87 THRU 8-14-87

INSPECTOR Thomas Murphy

TASK: Operator (RECLAIM)

EMPLOYEE: See signoff sheet attached

LOCATION: A & C

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

A B C D E F G H I J K L M N O P Q R S T

□ —— NORMAL OPERATIONS

○ —— EMERGENCY RESPONSE

Operator .

Operators operate the reclaim facility. They distill solvents from hazardous wastes in Location B (See Figure 1) in vessels (stills) using steam and vacuum. The distillate solvents are stored in the reclaim product tank farm. The residues from the stills are pumped to the waste fuel tank farm at Location C (See Figure 1).

Routine Procedures are as follows:

a) Charge amounts of 4000 and 2300 gallons.

b) Pumping hazardous waste from tanks in Location B to the still.

c) Still startup.

d) Distillation of solvents during run.

e) Sampling of residue to shutdown still.

f) Shutdown of still.

g) Pumping residue to Location C.

h) Digging still heating coils.

i) Distillation of solvents in #7 still.

Detailed procedures for steps (a) through (i) are attached.

b) Pumping hazardous waste from tanks in Location B to the still. Charges for the stills are contained in tanks 1A, 1B, 116-119, 120-126. Figures 2 and 3 are detailed drawings showing the tanks, piping, and valves. The procedure for charging a still from the storage tank is as follows:

1) The supervisor specifies the material to be charged; the amount, and the storage tank number. This information is written on a daily run sheet for each still.
2) The operator determines the inches corresponding to the specified gallons from the tank chart in part (a).
3) The operator, wearing an emergency belt (personnel alarm, eyewash and respirator), checks that the still is empty by opening the atmospheric vent valve on the still and then opening a drain valve on the bottom of the still. He drains the line into a bucket.
4) The operator turns on the still recirculating pump.
5) The operator opens valves on the transfer line between the storage tank and the still. He closes unused valves attached to the transfer line. The last valve to be opened is the storage tank valve.
6) The operator sets the pin on the 0 inches mark on the tank.
7) The operator opens the valve on the storage tank.
8) The operator turns on the transfer pump to pump material to the still.
9) The operator inspects the lines to check that the line has no leaks.
10) The operator watches the pin move on the storage tank to make sure that the material is being pumped from the proper tank.
11) The operator periodically checks the line to make sure it is not leaking.
12) The operator remains in the area while pumping to the still.
13) The operator closes the storage tank valve when the pin reaches the proper inches reading on the gauge.
14) The operator turns off the pump.
15) The operator closes all valves on line between the storage tank and the still.
16) The operator enters the time, storage tank number, still number, and gallons charged on the standard still run sheet.

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SAFETY AND HEALTH RISK ANALYSIS PROFILE

DATE: 7-27-87 THRU 8-4-87

INSPECTOR Thomas Murphy

TASK: Loader

EMPLOYEE: See signoff sheet attached

LOCATION: B & C

PROTECTION LEVEL: A B C D

REQUIRED PERSONAL PROTECTIVE EQUIPMENT

A B C D E F G H I J K L M N O P Q R S T

□ —— NORMAL OPERATIONS

○ —— EMERGENCY RESPONSE

3) Loaders

Loaders pump hazardous waste in storage tanks at Location C to a tank wagon in the loading area (See Figure 4).

Routine procedures are as follows:

a) Loading tank wagons with hazardous waste.

Hazardous waste is pumped from storage tanks in Location C to a tank wagon in the loading area. Figure 4 shows the location, pump, piping and valves for each tank. The gauges on the storage tanks are counterweight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 2 shows the gallons of material and corresponding inches on the straight side of each tank. The procedure for loading tank wagons is as follows:

1) The supervisor instructs the loader to load the tank wagon with a specified amount from a specified storage tank.
2) The loader, wearing a protective suit and a emergency belt, vents the tank wagon.
3) The loader opens the manway on the tank wagon.
4) The loader inspects the tank wagon to make sure that it is empty.
5) The loader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
6) The loader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
7) The loader connects the loading hose to the tank wagon.
8) The loader walks the line from the tank wagon to the storage, opening the proper valves and closing unused valves attached to the line.
9) The loader sets the pin on the weld mark on the tank approximately 7 feet off the ground.
10) The loader opens the valve on the storage tank.
11) The loader turns on the loading pump.
12) The loader walks the line from the storage tank to the tank wagon to check for leaks.
13) The loader looks into the top of the wagon to check that material is being pumped to the tank wagon.
14) The loader watches the pin move on the gauge at the tank to check that material is being pumped to the proper tank.
15) The loader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.
16) The loader remains in the area during the pumping of the material.
17) The loader checks the tank wagon level periodically to make sure that the specified amount will fit into the tank wagon.
18) The loader closes the valve on the storage tanks when the pin reaches the specified mark.

19) The loader turns off the loading pump.
20) The loader closes all valves between the storage tank and the tank wagon except for the valve on the tank wagon.
21) The loader blows the loading hose clear with nitrogen to remove any liquid in the line.
22) The loader closes the valve on the tank wagon.
23) The loader opens the bleeder valve on the line to relieve the nitrogen pressure.
24) The loader disconnects the loading hose.
25) The loader samples the tank wagon from the manway.
26) The loader closes the manway and vent valve.
27) The loader fills out the tank wagon manifest with the supervisor's approval.
28) The loader has the driver sign the manifest.
29) The loader retains the generator copy and returns it to the supervisor.
30) The loader disconnects the grounding device and removes the chocks.
31) The loader informs the driver that all valves are closed and hoses are disconnected.
32) If the filter on the loading pump should plug during loading, the following steps are taken:

    i) The loader closes the valve on the suction side of the filter.
    ii) The loader turns off the loading pump.
    iii) The loader opens the nitrogen valve on top of the filter to blow material out of the filter.
    iv) The loader closes the valve on the nitrogen line.
    v) The loader closes the valve on the outlet of the filter.
    vi) The loader opens the bleeder valve on the filter to relieve the pressure in the filter.
    vii) The loader removes the lid and cleans the filter by dumping its contents into an openhead drum.
    viii) The loader replaces the lid.
    ix) The loader tests the filter gasket with nitrogen.
    x) The loader opens the inlet and outlet valves on the filter.
    xi) The loader turns on the pump and continues loading the tank wagon.

4) Tractor driver

Some shipments of drums of hazardous waste arrive in trailers which are not the same height as the raised pad at Location A. The tractoe driver unloads the drums from the trailer and hauls them to the raised pad.

a) Unloading trailers of hazardous waste with the tractor.

Trailers, that are not the same height as the raised pad, are usually spotted in the area west of location A. Drums are transferred by the tractor driver to the raised pad. The procedure is as follows:

1) At the direction of the supervisor the tractor driver opens the doors of the trailer.
2) The tractor driver positions the tractor at the rear opening of the trailer with the drum bucket flush with the trailer floor.
3) The tractor driver chocks the trailer to prevent movement in both directions.
4) If there is no strong chemical odor, the tractor driver rolls 6 drums into the tractor bucket. If there is a strong chemical odor, the tractor driver makes his supervisor aware and awaits his instructions.
5) The tractor driver slowly raises the bucket about 6 inches and backs away from the trailer.
6) When the bucket is about 5 feet from the trailer, the tractor driver lowers the bucket to 1 foot from the ground.
7) The tractor driver transports the drums to the raised pad to unload them.
8) When the supervisor approves the drums, the tractor driver rolls them to a designated area.
9) The tractor driver continues to unload the trailer until it is empty.
10) The tractor driver removes the chocks.

Tractor driver - Rountine procedures

a) Unloading trailers of hazardous waste with the tractor. Trailers, that are not the same height as the raised pad, are usually spotted in the area west of Location A. Drums are transferred by the tractor driver to the raised pad. The procedure is as follows:

1) At the direction of the supervisor the tractor driver opens the doors of the trailer.

2) The tractor driver positions the tractor at the rear opening of the trailer with the drum bucket flush with the trailer floor.

3) If there is no strong chemical odor, the tractor driver rolls 6 drums into the tractor bucket.

4) The tractor driver slowly raises the bucket about 6 inches and backs away from the trailer.

5) When the bucket is about 5 feet from the trailer, the tractor driver lowers the bucket to 1 foot from the ground.

6) The tractor driver transports the drums to the raised pad to unload them.

7) When the supervisor approves the drums, the tractor driver rolls them to a designated area.

8) The tractor driver continues to unload the trailer until it is empty.

5) Laborer

Laborers assist tractor drivers and unloaders in unloading box trailers and pumping drums. Their efforts are regularly directed by supervisors, unloaders or tractor drivers and they wear the same PPE previously mentioned in this section. They also dig solids which collect in the storage tanks and stills during processing. The routine procedures are as follows:

a) The laborer rolls drums from a box trailer to the tractor bucket or the raised pad at Location A.
b) The laborer assists the unloader in pumping drums at Location A by opening bungs on designated drums or transferring the charge pipe from one drum to another which is already opened.
c) The laborer assists the unloader in charging viscous liquids from drums to the small blending tank by rolling drums to the dump box ramp or dumping their contents into the dump box.
d) The laborer assists the unloader in solidifying solid materia in drums by draining any free liquid from solid drums. This drained liquid is put into drums for future pumping to Location
e) The laborer rolls empty drums to the spotted trailer.
f) The laborer digs solids which collect in stills and storage tanks during processing. The procedure is covered under the Hazardous Atmosphere Entry Program.

6.) Solids Pail Loader

Work outline for the filling of 6 gallon pails of hazardous waste flammable solid material packaged and stored on pallets of 36 pails each.

A. The following list of equipment and tools to be used.

1. Mixing Tub
2. Filling Funnel
3. Plunger
4. Aluminum Shovels
5. Brass Hammer
6. Tow Motor & Fork Extender
7. Misc. Drum Opening Tools (Bung Wrench, Speed Wrench etc.)
8. Drum Tilter
9. Barrier Tape or Rope
10. Cones or Stanchions
11. PPE Personal Protective Equipment(Respirator with R-21 Cartridges with back up R-21 cartridges available)
12. Scale
13. Lid Crimper
14. Air Signal Horn
15. Eye Wash available

B. Following list of material to be secured

1. Bag(s) of Slikwik
2. 36-6 gallon pails
3. 1-GMA Pallet 40" x 48" (Pallet to be four way entry)
4. 36 Dot (Flammable Solids) and Hazardous Waste Labels (yellow)
5. Black felt tip marker
6. Chem-Fuel's Blend Log Sheet
7. Clip board, pen and pencil
8. Full or partial full 55 gallon drums of hazardous waste solids
9. 4 oz. sample jars
10. Paper towels

C. Secure the area around the mixing tub. (Refer to area layout attached) Notify the Site Health and Safety Officer for the purpose of inspection of the area and permission to proceed.

D. Locate the equipment and materials to be handled in the proper locations. (Either inside or outside containment area) Affix the proper PPE. The drum that is to be dumped into mixing tub must first be checked with the MX-241 for any sign of a high LEL reading.

E. With the Fork Extender attached to the Towmotor and the Drum Tilter fastened to the drum, dump the contents of drum into Mixing Tub. Use brass hammer and aluminum shovel to remove all the waste material from drum.

F. Secure the empty drum.

G. The mixing tub is to be checked again with the MX-241 to assure LEL level has not risen due to agitation of the material when dumping from the drum to the mixing tub. Size solids in the mixing tub and add Slikwik if necessary, to pick up any liquid that may be present. Take a 4 oz. sample of the solids in the mixing tub and record drum number on lid.

H. Place an empty 6 gallon pail under the funnel and shovel the solids from the mixing tub unto the funnel until the pail is full. Use the plunger to compress the mixture but do not exceed the top 1" rolling hoop (if Slikwik is added to the top of the pail, this also must be compressed so as not to exceed the top rolling hoop.)

I. The outside appearance of the pail is very important. Clean the pail sides with paper toweling, if necessary, and discard the dirty paper toweling into the next pail to be filled. The clean pail can now be removed from the secured area and placed in the designated Weigh and Label Area.

J. Continue filling the pails until the mixing tub is empty. All the solids that were emptied from drum No. 1 should be now in 6 gallon pails and stored in the Weigh and Label Area.

K. PPE is to remain on in the secured area during the filling operations. Remove and secure PPE (Protective suits, rubber gloves, respirator, etc.) before moving to the Weigh and Label Area.

L. Weigh pails, crimp the lids and record pounds on the lid(6 gallon pails are 26 guage and are not to exceed 60 pounds gross). Pail lids are also to be marked with the pallet letter and pail number. This information is then transferred to the Chem-Fuel "S" Blend Log Sheet along with the generator name, manifest document number and hazardous waste code.

M. DOT #4 Flammable Solid Label and Hazardous Waste Label are affixed to pail and stacked on pallet.

N. The Site Safety and Health Officer will monitor the transferring operations and make adjustments to the PPE based on his monitoring results. Each drum may require an upgrading or downgrading of the PPE level.

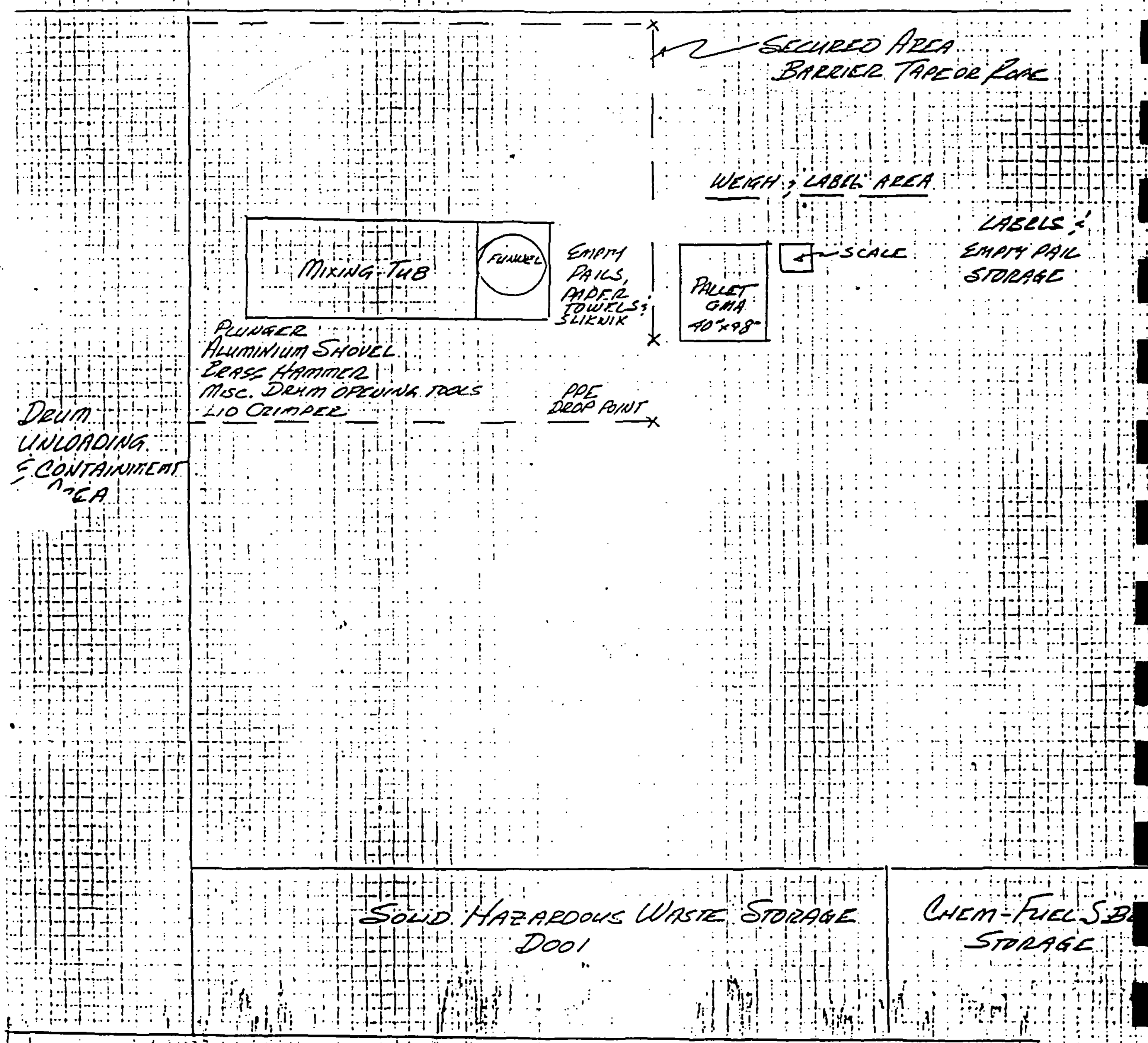
O. The Pail Filler will return to step "D"- affix the required PPE and begin operations on the next drum to be processed.

P. Shutdown and Decontamination Procedure:
   1. Scrape all the solids from the equipment used into the mixing tub.
   2. Remove the collected solids from the mixing tub and deposit them into a partially filled or empty drum of the same waste code.

3. Remove the PPE according to normal decontamination procedures. Disenfect and properly store the respirator.
4. Unsecure the area and return all equipment and unused materials.

Q. Return the empty drums to the proper storage area. Return the partially or full solid drums to the proper storage area.
Move partially or full pallets of pails to the designated storage area, return the Chem-Fuel "S" Blend Log Sheet and the samples to Production Supervisor.

CHEM-FUEL S BLEND AREA LAYOUT (TYPICAL)



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October 16, 1989

TO: All ACS Plant Personnel

TOPIC: Annual Air Purifying Respirator Training and Fit Test

1. Purpose:

   To familiarize plant personnel with the air filtering respirator with an opportunity to handle the respirator, have it fitted properly, test its face-piece-to-face-seal, wear it in normal air for a long familiarity period, and to wear it in a test atmosphere.

2. Advise the personnel to take the time to read the Air Purifying Respirator Training and Fit Test Program located in all of the Emergency Response Plan Books. At this time read and instruct the highlights of the program.

3. Advise personnel the locations of the respirators:

   A.) Emergency Belts
   B.) HMIS Cabinets
   C.) Personal issued respirators

4. Equipment:

   Respirators:
   A.) Willson Model 1700 - Full Face Mask
   B.) Willson Model 1200 - Half Face Mask
   C.) 3M 8500 Non-Toxic Particle Mask

   Cartridge:
   A.) Willson R-21 - Organic Vapors (Black)
   B.) Willson R-25 - Bromine, Chlorine & Organic Vapors (Yellow)
   C.) Willson R-26 - Formaldehyde & Acid Gases (White)
   D.) Willson R-24 - Ammonia & Amine (Green)

5. Parts and preuse inspection:

   A.) Face piece - check for cracks, holes, rips, etc.
   B.) Filter cartridge - check that correct cartridge is being used and that it is attached to face piece properly.
   C.) Exhalation valve cover - check that it is securly in place and free from obstructions.

D.) Elastic head band - (4 piece) - check that it is securly attached to face piece, that both male and female ends present, securly attached and operable. Check that straps can be adjusted freely and properly.

6. How to wear respirator:

   A.) Place the face piece against face with the narrow end over the nose and the chin in the chin cup.
   B.) Adjust the headbands behind the head so that the face piece sits snuggly and comfortable against the face.
   C.) Check that the respirator fits securly but not too tightly around the chin, doesn't pinch the nose, doesn't slip, and that it leaves enough room to move your head and to talk.

7. Have personnel perform preuse inspection and place respirator on their face and adjust to the proper fit.

8. Show Willson Respirator Fit Testing Film.

9. Fit Testing:

   Positive and Negative Sealing Tests:

   NEGATIVE-PRESSURE SEALING TEST A negative-air-pressure respirator sealing test can be used on air-purifying respirators equipped with tight-fitting respiratory -inlet coverings and on atmosphere-supplying respirators equipped with tight-fitting respiratory -inlet coverings and breathing tubes which can be squeezed or blocked at the inlet to prevent the passage of air. This test may be difficult or impossible to carry out on valveless respirators. The inlet opening of the respirator's canister(s), cartridge(s), or filter(s) is closed off by covering with palm of the hand(s), by replacing the inlet seal on a canister(s), or squeezing a breathing tube or blocking its inlet so that it will not allow the passage of air. Then the wearer inhales gently and holds his breath for at least 10 seconds. If a facepiece collapses slightly and no inward leakage of air into the facepiece is detected, it can be reasonably assured that the fit of the respirator to the wearer is satisfactory. For respirator equipped with a mouth-piece and nose clamp, if leakage of air into the nose or the mouth cannot be detected, than it can be resonable assured that the fit of the respirator to the wearer is satisfactory.

   POSITIVE-PRESSURE SEALING TEST A positive - air - pressure test can be used on respirators equipped with tight-fitting respiratory inlet coverings which contain both inhalation and exhalation valves. This test may be difficult or impossible to carry out on valveless respirators. The exhalation valve or breathing tube, or both is closed off and then the wearer exhales gently. The fit of a respirator equipped with a face piece is considered to be satisfactory if a slight positive pressure can be built up inside the facepiece without the detection of any outward leakage of air between the sealing surface of the facepiece and the respirator wearer's face.

The fit of a respirator equipped with a mouthpiece and nose clamp is considered satisfactory if the respirator wearer senses a buildup of positive pressure and is unable to detect an outward leakage of air through the nose and in the area between the mouth and the mouthpiece. For some respirators, this test method requires that the respirator wearer first remove an exhalation cover from the respirator and then replace it after completion of the test. These tasks often are difficult to carry out without disturbing the fit of the respirator to the wearer.

Qualitative Tests:

Irritant Smoke Test:

CAUTION: Irritant Smoke should only be handled in a well ventilated area. The actual Irritant Smoke Fit Test should also be performed in a well ventilated area.

CAUTION: Air purifying respirators used in the conduct of these fit test must be equipped with high efficiency cartridges. (Willson R-21)

CAUTION: Wear eye protection when opening tubes to protect from possible flying glass fragments.

CAUTION: Instructors must be knowledgable of Health Hazards, Emergency and First Aid Procedures of using the irritant smoke kit as outlined in the MSDS contained in the kit box.

1. The respirator to be tested shall be equipped with high efficiency R-21 cartridges.

2. The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its characteristic odor.

3. Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

4. Break both ends of an irritant smoke tube containing stannic oxychloride. CAUTION: To protect for flying glass, wear eye protection. A 2" piece of ¼" metal tubing works well for this purpose. Attach a short length (approximately 2 inches) of tubing to both ends of the smoke tube. Attach one end of the smoke tube with rubber tubing to the outlet end of the aspirator bulb.

5. The test conductor shall direct the stream of irritant smoke from the tube towards the face seal area of the test subject, beginning at a distance of at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

6. The test exercise shall be performed while the respirator seal is being challenged by the smoke. Each exercise shall be performed for one minute.

Test Exercises (One Minute Per Test)

A. Normal Breathing

B. Deep Breathing. Be certain breaths are deep and regular

C. Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on his shoulders. Have the test subject inhale when his head is at either side.

D. Nodding head up and down. Be certain motions are complete and made about every second. Alert the test subject not to bump the respirator on his chest. Have the test subject inhale when his head is in the fully up position.

E. Talking. Talk slowly and distinctly, counting backwards from 100.

F. Normal Breathing.

7. Each test subject passing the smoke test without evidence of a response shall be ginve a sesitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to envoke a response shall void the fit test.

8. The fit test shall be performed in a location with exhause ventilation sufficient to prevent general contamination or the testing area by the test agent. After each individual or group of individuals are tested with the irritant smoke, the portable exhaust fan will be operated to clear the air.

Amyl Acetate (Banana Oil) Test:

NOTE: In an emergency situation, (escape), a fit-test ampule may not be readily available, then you will need to use either the positive and/or negative pressure test.

1. The respirator to be tested shall be equipped with high efficiency R-21 cartridges.

2. The test subject shall be allowed to smell the amyl acetate before the respirator is donned to become familiar with its odor.

3. The test will be conducted in a plastic chamber (suspended drum liner).

Fit-test using the Scott Respirator Fit-test Ampules:

A.) Secure face piece to face with the proper cartridges after performing the preuse inspection.

B.) Crush ampule between thumb and forefinger.

C.) Place ampule approximately one to two inches from the face-piece-to-face-seal and move the ampule in a clockwise direction from the right side of the nose, 360 degrees around the edge of the face piece to the starting point while inhaling deeply.

D.) If no fragrance is detected, (bananas), a proper fit and seal has be obtained.

E.) If the fragrance of bananas is detected, reposition the respirator on the face and/or adjust the tension of the head-band to eliminate leaks.

WARNING: IF AT ANY TIME YOU CANNOT ACHIEVE A PROPER FIT OR SEAL USING THE ABOVE OUTLINED PROCEDURE - DO NOT ENTER ANY CONTAMINATED AREA!

10. Filter/Cartridge replacement

A.) Filters should be replaced when breathing becomes difficult. Generally, filter discs should be replaced after every eight hours of use.

B.) Chemical cartridges should be replaced when the wearer detects any taste, odor or irritation, or their senses indicate any abnormal condition.

11. After use care of respirator

A.) Carefully clean and disinfect every time.

B.) Perform the preuse inspection and report any problems to your supervisor.

C.) Store the respirator in the clean plastic bag and in an noncontaminated location.

D.) Keep it ready in case you need it.

12. Additional information

A.) Federal regulation 29 CFR 1910.34 states that the wearing of beards, long sideburns, bulky/long mustaches, contact lenses, temple pieces for glasses, missing false teeth, and any facial abnormality can and will interfere with obtaining an air tight seal and cannot be allowed on any person who is to be certified in the use of a respirator in a contaminated atmosphere. ACS has determined that they will include these rules in their guidelines for the wearing of respirators.

B.) In general, you cannot wear a respirator if you:

1.) Have breathing problems, such as asthma. (ALL employees have been certified by a doctor to wear a respirator.)

2.) Have a heart condition

3.) Have claustrophobia

4.) Are heat sensitive

C.) In an emergency, if there is no one around to ask if you should wear a respirator, play it safe: wear a respirator. Wear only the type of respirator and cartridge you have been instructed to wear by your Supervisor, Site Safety and Health Officer or as outlined by the Personal Protective Equipment Selection Guide.

D.) In any emergency DIAL #71 ASAP.

13. Questions and answer period.

14. Acknowledge your understanding of and prrticipation in training section by signing the signout sheet and the Respirator Fit Test Record.

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October 16, 1989

Topic: Air Purifying Respirator Training and Fit Test

A respirator is used because the concentration of a contaminant is high enough to cause some type of health effect. This may range from respiratory irritation to systemic damage or even death. The guide lines often used to decide the need for a respirator are the Threshold Limit Values. A concentration greater than the TLV requires respiratory protection. If the concentration is within the concentration used limits of an air-purifying respirator, then that type may be used. If it is greater, then an air supplying apparatus must be worn.

Air-purifying respirators can be used only under the following circumstances:

- The identity and concentration of the contaminant are known.
- The oxygen content in air is at least 19.5%.
- The periodic monitoring of the work area by the Site Safety and Health Officer except in the case of an emergency.
- The respirator assembly is approved for protection against the specific contaminant and concentration level. Check the Personal Protective Equipment Selection Guide.
- The type of respirator being used has been successfully fit-tested on the wearer.

PHYSIOLOGICAL EFFECT OF OXYGEN DEFICIENCY

% Oxygen (by volume) At Sea Level	Effects
21	Nothing abnormal
16-12	Loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination.

% Oxygen (by volume) At Sea Level	Effects
12-10	Very faulty judgment, very poor muscular coordination, muscular exertion causes fatigue that may cause permanent heart damage, intermittant respiration.
10-6	Nausea, vomiting, inability to perform vigorous movement, or loss of all movement, unconsciousness, followed by death.
<6	Spasmatic breathing, convulsive movements, death in minutes.

Section b 1-11 of OSHA 29 CFR 1910,134 as well as ANSI Z88.2-1980, requires a "Minimal Acceptable Program" to ensure sound respiratory protection practives. The balance of the regulations discusses specific requirements for respiratory use. The Minimal Acceptable Program is quoted from 29 CFR 1910.134 as follows:

1. Written standard operating procedures governing the selection and use of respirators shall be established.

2. Respirators shall be selected on the basis of hazards to which the worker is exposed. (ACS Personnel Protective Equipment Selection Guide July 1989. A copy is enclosed in all the Emergency Response Plan Books.)

3. The user shall be instructed and trained in the proper use of respirators and their limitations.

4. Where practicable, the respirators should be assigned to individual workers for their exclusive use if an individual is expected to wear a respirator as part of the job description .

5. Respirators shall be regularly cleaned and disinfected. Those issued for the exclusive use of one worker should be cleaned after each day's use, or more often if necessary. Those used by more than one worker shall be thoroughly cleaned and disinfected after each use.

6. Respirator shall be stored in a convenient, clean, and sanitary location in the approved and issued orange bag.

7. Respirators used routinely shall be inspected during cleaning. Worn or deteriorated parts shall be replaced. Respirators for emergency use, such as self-contained devices, shall be thoroughly inspected at least once a month and after each use. Problems--contact the Site Safety and Health Officer.

8. Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained. This is the responsibility of the Site Safety and Health Officer.

9. There shall be regular inspection and evaluation by the Site Safety and Health Officer to determine the continued effectiveness of the program.

10. Persons will not be assigned to tasks requiring use of respirators unless it has been determined that they are physically able to perform the work and use the equipment. A physician shall determine what health and physical conditions are pertinent. The respirator user's medical status will be reviewed annually.

Types of Air Purifying Devices

Basically, respiratory hazards can be broken down into two classes: particulates and vapors/gases. Particulates are filtered by mechanical means, while vapors and gases are removed by sorbents that react chemically with them. Respirators, using a combination of mechanical filter and chemical sorbent, will effectively remove both hazards.

Particulate-Removing Filters

Particultes can occur as dusts, fumes, or mists. The particle size can range from macroscopic to microscopic, and their toxicological effects can be severe or innocuous. The hazard posed by a particulate can be determined by its TLV. A nuisance particulate will have a TLV of 10 mg/m^3. Check Emergency Response Plan Books for TLV values for substances being used.

Vapor-or Gas Removing Cartridges

Sorbents are manufactured to remove a specific chemical or group of chemicals. In contrast, particulate-removing filters remove particulates regardless of their composition. Sorbents are available to remove specific organic vapors, acid gases, and ammonia, among others. Each sorbent has a maximum concentration use limit for that specific contaminant. Once a sorbent has been filled up with the contaminant, it will "break through"--that is, it will allow the full ambient concentration of the contaminant to enter the face piece. Again, in contract, particulate removing filters become more efficient (but harder to breath through) as they fill up. There is no break-through.

Chemical sorbents also vary in their ability to remove contaminants (Table 1). For example, vinyl chloride takes only 3.8 minutes to reach a 1% break-through -- that is, for 1% of the ambient concentration to enter the face piece. In comparison, it takes 107 minutes for chlorobenzene to reach 1% break-through. Thus, to reach 1% break-through. Thus, chlorobenzene is removed much more efficiently than vinyl chloride. Cartridge efficiencies (Table 1) should also be considered when selecting air-purifying respirators.

Chemical sorbent cartridges have an expiration date. They may be used up to that date as long as they were not opened previously. Once opened, they begin to sorb humidity and air contaminants, whether or not they are in use, and their efficiency and service life decrease. A cartridge should be discarded after it is used. This is the reason that respirators with cartridges attached <u>must</u> be stored in a sealed plastic bag.

Limits of Cartridges

Cartridges used to clean breathing air do not remove the contaminant efficiently forever. Eventually, they will no longer filter or sorb the contaminants. The higher the concentration, the faster the cartridge is used up. To avoid quick wearing out and afford longer service, cartridges are assigned a maximum use concentration above which they should not be used.

IDLH

An air-purifying respirator can be worn in atmospheres up to the concentration limits placed on its cartridge. This holds as long as the maximum use concentration is not immediately dangerous to life or health (IDLH) -- that is, one that causes irreversible damage to life or health within 30 minutes by toxic action. An atmosphere which is within the flammable or explosive limits of the contaminant is also considered IDLH. If the concentration is at an IDLH level and still within the use limits approved for the cartridge, that respirator cannot be worn. Only an approved positive pressure self-contained breathing apparatus is allowed.

Service Life

Each sorbent has a finite capacity for removing contaminants and when this limit is reached the cartridge is said to be saturated. At this point the cleaning element will allow the contaminant to pass through and enter the facepiece. The length of time a cartridge will effectively sorb the contaminant is known as the service life of the element. Service life of a type of cartridge is dependent on several factors: the breathing rate of the wearer; contaminant concentration; and sorption efficiency.

Breathing Rate

If the breathing rate of the user is rapid, the flow rate of the contaminated air drawn through the cartridge is greater than it is at a moderate or slow respiration rate. A higher flow rate brings a larger amount of contaminant in contact with the sorbent in a given period of time which, in turn, increases the rate of sorbent saturatio and shortens service life.

Contaminant Concentration

The expected service life of an organic vapor cartridge decreases as ambient contaminant concentration increases. As concentration goes up, the mass flow rate increases bringing more contaminant in contact with the sorbent in given period of time. For example, at any constant breathing rate, ten times as much contaminant contacts the element when the concentration is 500 ppm compared to 50 ppm.

Cartridge Efficiency

Chemical sorbents vary in their ability to remove contaminants from air. Table 1 compares the efficiency of organic vapor cartridges for a number of solvents by recording the amount of time until a 1% breakthrough concentration was measured in the cartridge-filtered air. The initial test concentration is 1000 ppm of solvent vapor; the breakthrough concentration is 10 ppm. From the table it can be seen that it takes 107 minutes for chlorobenzene to reach a 1% breakthrough, while it only takes 3.8 minutes for vinyl chloride. The sorbent (activated carbon) in the organic vapor cartridge is much better for removing chlorobenzene than vinyl chloride under the test conditions. Cartridge efficiencies need to be considered when selecting and using respirators.

Warning Properties

A warning property is a sign that a cartridge or canister in use is beginning to lose its effectiveness. A warning property can be detected as an odor, taste, or irritation. At the first such signal, the old cartridge or canister must be exchanged for a fresh one. Without a warning property, respirator efficiency may drop without the knowledge of the wearer, ultimately causing a health hazard.

Most substances have warning properties at some concentration. A warning property detected only at dangerous levels -- that is, greater than TLV -- is not considered adequate. An odor, taste, or irritation detected at extremely low concentrations is also not adequate because the warning is being given all the time or long before the filter begins to lose its effectiveness. In this case, the wearer would never realize when the filter actually becomes ineffective. See Table 2.

Resipirator Cleaning

Once a respirator has been used, it must be cleaned. All detachable parts, such as straps, valves, and gaskets, are removed and cleaned separately. Cartridges cannot be cleaned. They can be used again if their service life has not been exhausted. The face piece and other parts can be washed separately in sanitizer solution made by the manufacturer of the respirator. The parts should go through two water rinses and left to air dry. When dry, the parts are assembled and the respirator is put in a clean sealable plastic bag, in the orange bag, and stored where it will be protected from conditions that could alter the shape of the mask, high temperatures, or very dusty environments.

Donning and Fit-Testing

The OSHA regulations, in 29 CFR 1910.134 (e)(5)(i) state: "Every respirator wearer shall receive fitting instruction, including demonstrations and practice, in how the respirator should be worn, how to adjust it, and how to determine if it fits properly. Respirators shall not be worn when conditions prevent a good face seal. Such conditions may be a growth of a beard, sideburns, a skull cap, that projects under the face piece, or temple pieces on glasses. Also, the absence of one or both dentures can seriously affect the fit of a face piece. The worker's dilligence in observing these factors shall be evaluated by periodic check. To assure proper protection, the face piece fit shall be checked by the wearer each time he puts on the respirator. This may be done by fitting instructions."

1. Fitting

. Place the respirator over the face and draw the straps securely. The mask should not be so tight as the cause discomfort or a headache. Secure bottom straps first.

2. Pressure Testing

. Once the respirator is on, make two pressure tests:

. Negative pressure test:

-- Close off cartridge inlet with the palm of the hand.

-- Gently inhale so the face piece collapes against the face for about 10 seconds.

-- Determine by an inward rushing of air if the negative pressure within the face piece is maintained over the 10 seconds.

. Positive pressure test:

-- Close off exhalation valve with the palm of the hand. (Valve cover may have to be removed.)

-- Gently exhale into the face piece so a slight positive pressure builds.

-- Note if the positive pressure can be built. If it cannot, air is leaking out.

Qualitive Fit-Test

Perform a qualitative fit-test with isoamyl acetate (banana-like odor) before using a respirator under hazardous conditions.

Protection Factors (PF)

If a respirator passes the qualitative test, it can be worn in concentrations determined by the assigned Protection Factor (PF). The maximum concentration is calculated by multiplying the TLV of the contaminant by its PF. PFs for cartridge respirators are:

. Half-face mask, 10X
. Rull-face mask, 100X

Example: protection(ppm) - PF x TLV

$TLV_x = 10$
$PF = 10$
$= 10 \times 10$
$= 100$ ppm

Thus, for substance x with a TLV of 10, the half-mask respirator provides protection up to concentration of 100 ppm of the substance.

TABLE 1

EFFECT OF SOLVENT VAPOR ON RESPIRATOR CARTRIDGE EFFICIENCY[1]

Solvent	Time to Reach 1% Breakthrough (10 ppm) Minutes (2)
Aromatics [3]	
Benzene	73
Toluene	94
Ethyl benzene	84
m-Xylene	99
Cumene	81
Mestiylene	86
Alcohols [3]	
Methanol	0.2
Ethanol (ETHYL ALCOHOL)	28
Isopropanol (IPA)	54
Allyl alcohol	66
n-Propanol	70
sec-Butanol (SEC-BUTYL ALCOHOL)	96
Butanol (BUTYL ALCOHOL)	115
2-Methoxyethanol	116
Isoamyl alcohol	97
4-Methyl-2-pentanol	75
2-Ethoxyethanol	77
Amyl alcohol	102
2-Ethyl-1-butanol	76.5
Monochlorides [3]	
Methyl chloride (METHYLENE CHLORIDE)	0.05
Vinyl chloride	3.8
Ethyl chloride	5.6
Allyl chloride	31
1-Chloropropane	25
1-Chlorobutane	72
Chlorocyclopentane	78
Chlorobenzene	107
1-Chlorohexane	77
o-Chlorotoluene	102
1-Chloroheptane	82
3-(Chloromethyl heptane)	63

TABLE 1 (Cont'd)

Solvent	Time to Reach 1% Breakthrough (10 ppm) Minutes
Dichlorides [3]	
Dichloromethane	10
trans-1,2-Dichloroethylene	33
1,1-Dichloroethane	23
cis-1,2-Dichloroethylene	30
1,2-Dichloroethane	54
1,2-Dichloropropane	65
1,4-Dichlorobutane	108
o-Dichlorobenzene	109
Trichlorides [3]	
Chloroform	33
Methyl chloroform (1,1,1 Tri)	40
Trichloroethylene	55
1,1,2-Trichloroethane	72
1,2,3-Trichloropropane	111
Tetra- and Pentachlorides [3]	
Carbon tetrachloride	77
Perchloroethylene	107
1,1,2,2-Tetrachloroethane	104
Pentachloroethane	93
Acetates [3]	
Methyl acetate	33
Vinyl acetate	55
Ethyl acetate	67
Isopropyl acetate	65
Isopropenyl acetate	83
Propyl acetate	79
Allyl acetate	76
sec-Butyl acetate	83
Butyl acetate	77
Isopentyl acetate	71
2-Methoxyethyl acetate	93
1,3-Dimethylbutyl acetate	61
Amyl acetate	73
2-Ethoxyethyl acetate	80
Hexyl acetate	67
Ketones [4]	
Acetone	37
2-Butanone	82
2-Pentanone	104
3-Pentanone	94
4-Methyl-2-pentanone	96
Mesityl oxide	122
Cyclopentanone	141
3-Heptanone	91

TABLE 1 (Cont'd)

Solvent	Time to Reach 1% Breakthrough (10 ppm) Minutes
Ketones [4]	
2-Heptanone	101
Cyclohexanone	126
5-Methyl-3-heptanone	86
3-Methylcyclohexanone	101
Diisobutyl ketone	71
4-Methylcyclohexanone	111
Alkanes [4]	
Pentane	61
Hexane	52
Methylcyclopentane	62
Cyclohexane	69
2,2,4-Trimethylpentane	68
Heptane	78
Methylcyclohexane	69
5-Ethylidene-2-norbornene	87
Nonane	76
Decane	71
Amines [4]	
Methyl amine	12
Ethyl amine	40
Isopropyl amine	66
Propyl amine	90
Diethyl amine	88
Butyl amine	110
Triethyl amine	81
Dipropyl amine	93
Diisopropyl amine	77
Cyclohexyl amine	112
Dibutyl amine	76
Miscellaneous materials [4]	
Acrylonitrile	49
Pyridine	119
1-Nitropropane	143
Methyl iodide	12
Dibromomethane	82
1,2-Dibromoethane	141
Acetic anhydride	124
Bromobenzene	142

1 Nelson, G.O., and C.A. Harder. Respirator Cartridge Efficiency Studies, University of California, Livermore. 1976.

2 Cartridge pairs tested at 1000 ppm, 50% relative humidity, 22°C, and 53.3 liters/minute (equivalent to a moderately heavy work rate). Pair cartridges preconditioned at room temperature and 50% relative humidity for at least 24 hours prior to testing.

3 Mine Safety Appliances Cartridges.

4 American Optical Cartridges.

TABLE 2

Odor thresholds in air as compared to threshold limit values

Charles E. Billings, Ph.D.
Johns Hopkins University
Baltimore, MD

Linda C. Jonas
Baltimore Gas & Electric Co.
Baltimore, MD

The following Table of Odor Thresholds in Air as Compared to TLV's (1979) is of value in field surveys, for recognition of exposures. We also have found it useful in education of workers and industrial hygiene students.

Odor thresholds are from the 1967 Arthur D. Little study for MCA.

Odor Thresholds in Air as Compared to Threshold Limit Values (1979)

			Adopted Values TWA		Tentative Values STEL	
Compound	ppm	Odor Description	ppm	mg/m	ppm	mg/m3
Acetaldehyde	0.21	Green, Sweet	100	180	150	270
Acetic acid	1.0	Sour	10	25	15	37
Acetone	100.0	Chemical sweet, pungent	750	1780	1000	2375
Acrolein	0.21	Burnt sweet, pungent	0.1	0.25	0.3	0.8
Acrylonitrile	21.4	Onion-garlic pungency	(a)			
Allyl Chloride	0.47	Garlic-onion pungency, green	1	3	2	6
Amine dimethyl	0.047	Fishy	10	18	—	—
Amine, monomethyl	0.021	Fishy, pungent	—	—	—	—
Amine, Trimethyl	0.00021	Fishy, pungent	—	—	—	—
Ammonia	46.8	Pungent	25	18	35	27
Aniline	1.0	Pungent	2	10	5	20
Benzene	4.68	Solvent	10(b)	—	—	—
Benzyl chloride	0.047	Solvent	1	5	—	—
Benzyl sulfide	0.0021	Sulfidy	—	—	—	—
Bromine	0.047	Bleach, pungent	0.1	0.7	0.3	2
Butyric acid	0.001	Sour	—	—	—	—
Carbon disulfide	0.21	Vegetable sulfide	10	30	—	—
Carbon tetrachloride (chlorination of CS_2)	21.4	Sweet pungent	5(b)	30	20	125
Carbon Tetrachloride (chlorination of CH_4)	100.0					
Chloral	0.047	Sweet	—	—	—	—
Chlorine	0.314	Bleach, pungent	1	3	3	9
Dimethylacetamide	46.8	Amine, burnt, oily	10	35	15	50
Dimethylformamide	100.0	Fishy, pungent	10	30	20	60
Dimethyl sulfide	0.001	Vegetable sulfide	—	—	—	—
Diphenylether (perfume grade)	0.1		—	—	—	—
Diphenyl sulfide	0.0047	Burnt rubbery	—	—	—	—
Ethanol (synthetic) (ETHYL ALCOHOL)	10.0	Sweet	— 1,000	— 1910	—	—
Ethyl acrylate	0.00047	Hot plastic, earthy	5	20	25	100
Ethyl mercaptan	0.001	Earthy, sulfidy	0.5	1	2	3
Formaldehyde	1.0	Hay (straw-like) pungent	2(c)	3	—	—
Hydrochloric acid gas	10.0	pungent	—	—	—	—
Hydrogen sulfide (from Na_2S)	0.0047	Eggy sulfide	10	15	15	27
Hydrogen sulfide gas	0.00047					
Methanol	100.0	Sweet	200	260	250	310
Methyl chloride	(above 10 ppm)		50	105	100	205
Methylene chloride	214.0		100	360	500	1,700
Methyl ethyl ketone (MEK)	10.0	Sweet	200	590	300	885
Methyl isobutyl ketone (MIBK)	0.47	Sweet	100	410	125	510
Methyl mercaptan	0.0021	Sulfidy, pungent	0.5	1	—	—
Methyl methacrylate	0.21	Pungent, sulfidy	100	410	125	510
Monochlorobenzene	0.21	Chlorinated, moth balls	—	—	—	—
Nitrobenzene	0.0047	Shoe polish pungent	1	5	2	10
Paracresol	0.001	Tar-like, pungent	—	—	—	—
Paraxylene	0.47	Sweet	—	—	—	—
Perchloroethylene	4.68	Chlorinated solvent	~~100~~ 50	~~670~~ 335	~~150~~ 200	~~1000~~ 1340

TABLE 2 (Cont'd)

Odor Thresholds in Air as Compared to Threshold Limit Values (1979) (con't)

Compound	ppm	Odor Description	Adopted Values TWA ppm	Adopted Values TWA mg/m	Tentative Values STEL ppm	Tentative Values STEL mg/m3
Phenol	0.047	Medicinal	5	19	10	38
Phosgene	1.0	Hay-like	0.1	0.4	—	—
Phosphine	0.021	Oniony, mustard	0.3	0.4	1	1
Pyridine	0 021	Burnt, pungent, diamine	5	15	10	20
Styrene (inhibited)	0.1	Solventy, rubbery				
Styrene (uninhibited)	0.047	Solventy, rubbery, plasticy	50	215	100	425
Sulfur dichloride	0.001	Sulfidy	—	—	—	—
Sulfur dioxide	0.47		2	5	5	13
Toluene (from coke)	4.68	Floral, pungent, solventy	100	375	150	560
Toluene (from petroleum)	2.14	Moth balls, rubbery	—	—	—	—
Tolylene diisocyanate	2.14	Medicated bandage, pungent	0.005	0.04	0.02	0.15
Trichloroethylene	21.4	Solventy	50	270	~~150~~ 200	~~800~~ 1080

(a) Human carcinogen: Substance recognized to have carcinogenic potential without an assigned TLV.
(b) Chemical substance suspected of inducing cancer based on either (1) limited epidemiologic evidence, exclusive of clinical report of single cases, or (2) demonstration of carcinogenesis in one or more animal species by appropriate methods.
(c) It is expected that this substance will soon be classified in category (b) above.

AMERICAN CHEMICAL SERVICE

HAZARDOUS ATMOSPHERE ENTRY PROGRAM

Revised: Dec 1989

SUBJECT: A written procedure covering the safe use of artificial breathing devices in toxic or oxygen-deficiant atmospheres

PURPOSE: To instruct the employees in the proper methods of entering hazardous atmospheres for scheduled maintenance or rescue purposes.

Outline: A.) Description of Equipment

1.) 3M Hose Mask (White Cap)
2.) MSA Air Mask (SCBA)
3.) Lifeair 5 or 10 minute Escape Breathing System
4.) ARAP w/Escape
5.) Suit Alert Model 952
6.) Chemrel Haz Mat Suit C-106
7.) Harness

B.) Equipment inspection prior to use.

C.) Procedure for entering a hazardous atmosphere

1.) Scheduled Maintenance
2.) Rescue

D.) Equipment inspection after use.

CONFINED SPACE CLASSIFICATION TABLE

Parameters	Class A	Class B	Class C
Characteristics	Immediately dangerous to life—rescue procedures require the entry of more than one individual fully equipped with life support equipment—maintenance of communication requires an additional standby person stationed within the confined space	dangerous, but not immediately life threatening—rescue procedures require the entry of no more than one individual fully equipped with life support equipment—indirect visual or auditory communication with workers	potential hazard—requires no modifications of work procedures—standard rescue procedures—direct communication with workers, from outside the confined space
Oxygen	16% or less *(122 mm Hg) or greater than 25% *(190 mm Hg)	16.1% to 19.4% *(122-147 mm Hg) or 21.5% to 25% (163-190 mm Hg)	19.5%-21.4% *(148-163 mm Hg)
Flammability characteristics	20% or greater of LFL	10%-19% LFL	10% LFL or less
Toxicity	**IDLH	greater than contamination level, referenced in 29 CFR Part 1910 Sub Part Z—less than **IDLH	less than contamination level referenced in 29 CFR Part 1910 Sub Part Z

*Based upon a total atmospheric pressure of 760 mm Hg (sea level)
**Immediately Dangerous to Life or Health—as referenced in NIOSH Registry of Toxic and Chemical Substances, Manufacturing Chemists data sheets, industrial hygiene guides or other recognized authorities.
DHEW (NIOSH) Publication No. 80-106

There are two types of fit-tests: quantitative and qualitative. The quantitative test is an analytical determination of the concentration of a test agent inside the facepiece compared to that outside the mask. This concentration ratio is called the Protection Factor (PF) and is a measure of the relative protection offered by a respirator. For example, if the ambient concentration of the test agent is 1000 ppm, this respirator gives the tested individual a PF of 100. So:

$$PF = \frac{\text{Concentration outside mask}}{\text{Concentration inside mask}}$$

Because quantitative tests are expensive and tedious, qualitative tests are most often performed to check respirator fit. A qualitative fit-test is not an analytical measurement. It is a subjective test where an irritant or aroma is used to determine if there is a good facepiece-to-face seal. If the test subject does not respond (by smelling, tasting, coughing, etc.) to the test agent, he/she can wear the tested respirator with a PF assigned for that type of mask. Table 2 lists several types of respirators and their PF's.

A Protection Factor is used to determine the Maximum Use Limit (MUL) of a successfully fit-tested respirator. The MUL is the highest concentration, not exceeding IDLH concentration, of a specific contaminant in which a respirator can be worn:

$$MUL = PF \times TLV$$

For example, if a contaminant has a TLV-TWA of 10 ppm, then the MUL for any half-mask respirator is 100 ppm; the MUL for a full facepiece APR or demand SCBA is 1000 ppm. If the ambient concentration is greater than 1000 ppm, then a pressure demand SCBA is required.

Table 2

Selected Respirator Protection Factors*

Type of Respirator	PF (Qualitative Test)
Air-purifying	
quarter-mask	10
half-mask	10
Air-line	
quarter-mask	10
half-mask	10
Hose mask	
full facepiece	10
SCBA, demand	
quarter-mask	10
half-mask	10
Air-purifying	
full facepiece	100
Air-line, demand	
full facepiece	100
SCBA, demand	
full facepiece	100
Air-line, pressure-demand, with escape provision	
full facepiece (no test required)	10,000+
SCBA, pressure-demand or positive pressure	
full facepiece (no test required)	10,000+

A.) Description of Equipment:

1.) 3M Hose Mask (White Cap):

a.) Helmet 3M Whitecap Model 5005AA or Disposable Hood W-5220-6 and Collar Assembly W-2812

b.) Breathing Tube W-5114

c.) Air Regulating Valve Assembly W-2907

d.) High Pressure Hose 50'

e.) F & P Series 10A3500 Flowmeter

f.) Pressure Regulator w/hose D4X40 R-205

g.) 2-K Size 229 cu. ft. Breathing Air Cylinders

2.) MSA Air Mask (SCBA):

a.) Mask Assembly BM-13D-17

b.) Breathing Tube #449267

c.) Regulator Assembly w/high pressure hose Model 401

d.) Air Tank 45 cu. ft. @ 2216PSIG

e.) Emergency Horn

3.) Life Air 5 and 10 minute Escape Breathing System

a.) Adjustable Hood

b.) Breathing Tube

c.) Regulator

d.) Air Tank

e.) Carrying Pouch w/Shoulder Strap

4.) ARAP w/Escape (Airline Respirator Apparatus):

a.) Full Facepiece

b.) Demand Valve

c.) Air Supply Hose (up to 300 feet)

d.) Emergency Egress Unit

5.) Suit Alert Model 952

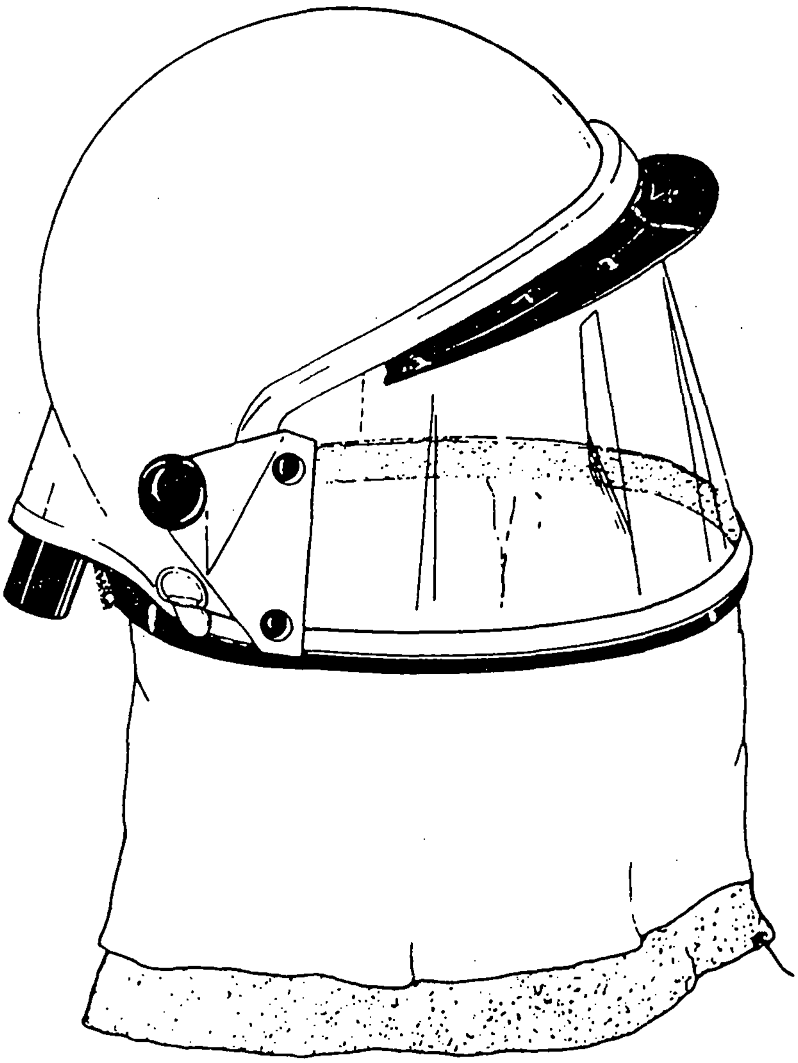
6.) Chemrel Haz Mat Suit C-106

7.) Harness-Nylon chest harness with 25 ft. ½" nylon rope Model 5409N

Operating and Maintenance Instructions

Product Part Number 78-8007-5158-4

3M Brand Whitecap® Helmet W-5005



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Litho in U.S.A.

Occupational Health and
Safety Products/3M
230-B 3M Center
St. Paul, MN 55144

3M

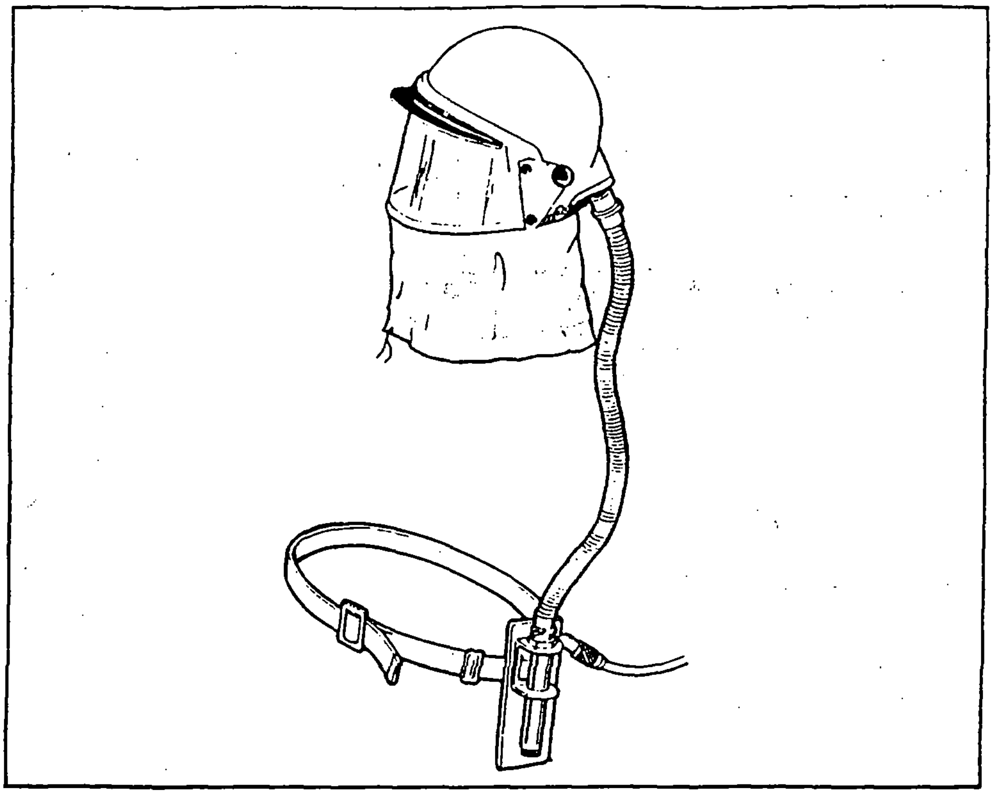


Figure 4-1.
Whitecap® Helmet Connected to
Air Supply Component

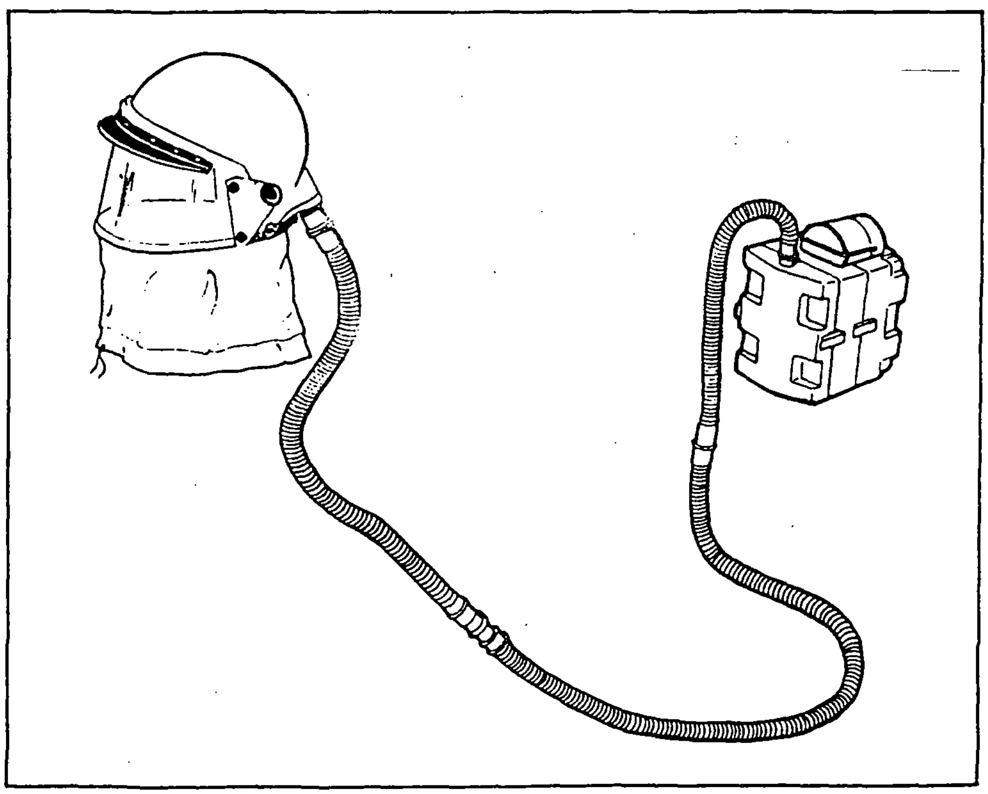


Figure 4-2.
Whitecap™ Helmet Connected to
3M Brand Powered Air Purifier

Supplied Air Respiratory Systems

Supplied air systems provide better protection than cartridge respirators since air comes from a clean, noncontaminated source—either a cylinder or a remotely located breathable air pump. Use with hoses supplied with the units in order to retain approval codes. Systems are available in two styles of air supply.

PRESSURE DEMAND—Additional air flow is provided only as the user breathes. The system maintains a slight positive pressure inside the facepiece during inhalation and provides low resistance to exhalation. These systems require less air than constant flow systems, but are more expensive due to the regulator required.

CONSTANT FLOW—Air is continuously supplied without regulation in the unit.

All air supplied must conform to Grade D of Compressed Gas Association Commodity specification for Air G7.1 ANSI Z86.1 or a plant compressed air system that complies with OSHA regulation 29CFR 1910.134 (d). Selection of breathing apparatus depends on expected length of time the apparatus will be used and flexibility needed to meet varying applications within your workplace.

* MSA AIR MASK (SCBA)

Self-Contained Pressure Demand Breathing Apparatus

Lightweight apparatus allows workers to enter and exit a dangerous area using cylinder air.

Both units include facepiece with headbands, exhalation valve, breathing tube and pressure demand regulator that meters air to breathing tube. Apparatus also has high pressure air supply hose, audible low-pressure alarm, air cylinder and body harness.

Dual purpose unit includes pressure regulator and hookup for use with up to 300 ft. of air line...allows work for an extended period of time. Air must be within pressure range of 85-90 psig at inlet.

Both units have a 45 cubic foot air storage cylinder with National Institute of Occupational Safety and Health (NIOSH) rated service life of 30 minutes. The units are approved by the Mine Safety and Health Administration (MSHA), under subpart H, 30CFR, Part 11 for a 30 minute service life.

No. 5569T55 meets requirements of National Fire Protection Association (NFPA) standard 1981 and American National Standards Institute (ANSI) Z86.1.

Description	NIOSH Approval	Complete Unit No.	Complete Unit NET EACH	Replacement Cylinder No.	Replacement Cylinder NET EACH
Self-Contained Breathing Apparatus	TC-13F-138	5569T55	$1448.46	5569T13	$332.79
Dual Purpose Self-Contained Breathing Apparatus	TC-13F-154	5569T75	1938.46	5569T78	441.80
25-ft. Neoprene Hose with Female ¾"-16NF Fitting	—	—	—	5569T79	95.33

Constant Flow Respirators

Full Faceplece

Half Faceplece

These respirators are designed for use in any atmosphere not immediately dangerous to life or health, and from which wearer can escape without aid or mask.

Respirators must be used with an external supply of clean, respirable, compressed air at minimum psi shown in the table.

The compressor used to supply air must be capable of delivering a minimum of 4 cfm to a supplied air respirator.

Facepieces are furnished with corrugated inlet hose, waist belt, and quick-connect coupler with ⅜" air hose.

Maximum hose length allowed is 100 ft.

Full Facepiece—Wide angle, shock resistant lens plus adjustable headbands with quick-release buckles.

Half Facepiece—Body is aluminum with an under-chin face cushion and two headbands.

Hose Lgth.	Air Supply★	NIOSH Approval	No.	NET EACH
FULL FACEPIECE				
25-ft.	6-8 psi	TC-19C-82	5576T11	$218.68
50-ft.	6-8 psi	TC-19C-82	5576T12	259.55
HALF FACEPIECE				
25-ft.	6-9 psi	TC-19C-95	5494T11	146.50
50-ft.	6-9 psi	TC-19C-95	5494T12	189.00

★ Must be used for National Institute of Occupational Safety and Health (NIOSH) approval.

* ARAP W/ ESCAPE

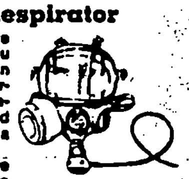
Pressure Demand Respirator with Escape Cylinder

Respirator is equipped with a small air cylinder for escape in case air line is damaged...compact design fits through tight areas. Unit provides respiratory protection in atmospheres that are immediately dangerous to life and health such as oil drilling and manufacturing and handling certain chemicals. Air line inlet pressure is 65-85 psig. Manually operated, self-contained air supply is approved for escape only. Cylinder rated service life is five minutes, but may be less during exertion.

Approved by National Institute for Occupational Safety and Health (NIOSH) and Mine Safety and Health Administration (MSHA) approval TC-13F-143.

Description	No.	NET EACH
Complete Apparatus in Case	54545T17	$799.17
Replacement Cylinder	54545T18	255.25
25-ft. Air Supply Hose	5569T79	95.33

Pressure Demand Respirator



The respirator is connected to a remote air supply that provides air flow as you breathe...allows extended work within an oxygen deficient area and where dangerous concentrations of toxic gases and vapors are present. Respirator may be used with an in-plant compressed air system, a cascade system and a single cylinder.

Pressure regulator and exhalation valve maintain positive pressure inside mask to prevent leakage of contaminated air into mask. Silicone facepiece has six-strap attachment. These respirators are not approved for use in environments that are immediately dangerous to life and health.

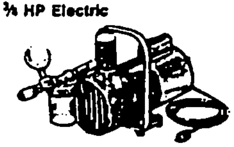
HEPA egress filter allows workers to escape from a particulate contaminated area if air supply is interrupted. Respirator requires 75 psi minimum and 125 maximum. Maximum hose length is 150 ft.

Description	NIOSH Approval	No.	NET EACH
Facepiece	TC-19C-212	55925T4	$361.54
Facepiece with HEPA Egress	TC-21C-393	55925T5	376.92
25-ft. Supply Hose Assembly	—	55925T81	53.82
50-ft. Supply Hose Assembly	—	55925T82	87.19

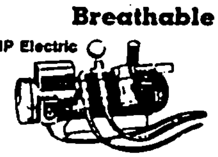
Replacement HEPA Filters (10/box). No. 55925T7 NET/BOX $40.91

Breathable Air Pumps

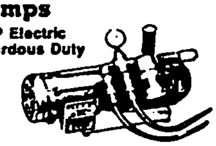
¾ HP Electric



1½ HP Electric



1½ HP Electric For Hazardous Duty



1½ HP Compressed Air

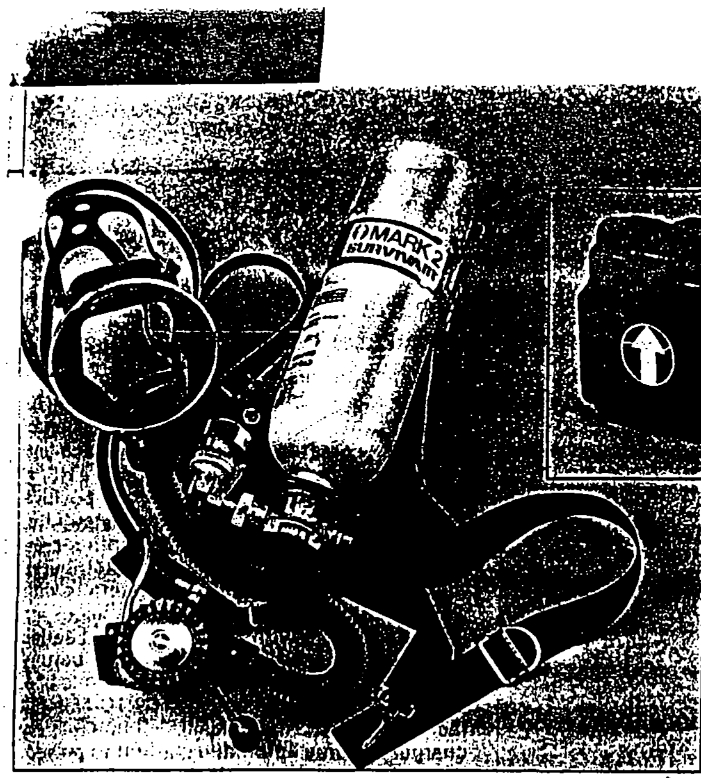
Use these pumps for the supplied air respirators which require a low pressure inlet of oxygen with air line hoses sold above. Oilless pumps produce no carbon monoxide, oil vapor and mist.

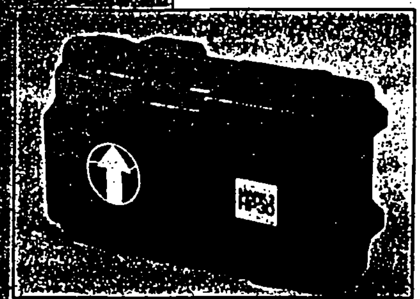
Pumps deliver air to one or two workers and can be used to supply full hood and half- and full-facepiece respirators. They are compact and portable for spraying, sandblasting and grinding operations.

All models are approved at pressure ranges at or below 15 psig. They do not require air line carbon monoxide monitors and high temperature alarms. Models are available for general purpose use in addition to hazardous duty operations.

HP	Supplies No. of Respirators: Full Hood	Supplies No. of Respirators: Half or Full Faceplece	Maximum Supply Pressure	No.	NET EACH
ELECTRIC—115 VAC					
¾	1	1-2	11 psi	56825T66	$845.83
1½	2	3	15 psi	56825T67	1361.15
1½	2	3	15 psi	56825T68•	1599.00
COMPRESSED AIR—80 PSI Supply					
1½	2	3	15 psi	56825T69•	1612.80

• May be used in hazardous duty operations.





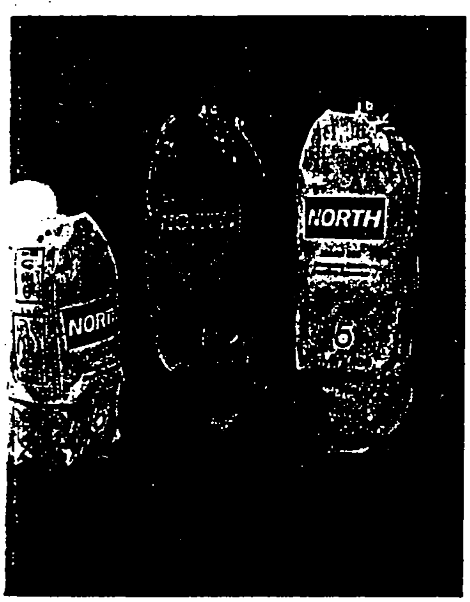
SURVIVAIR®

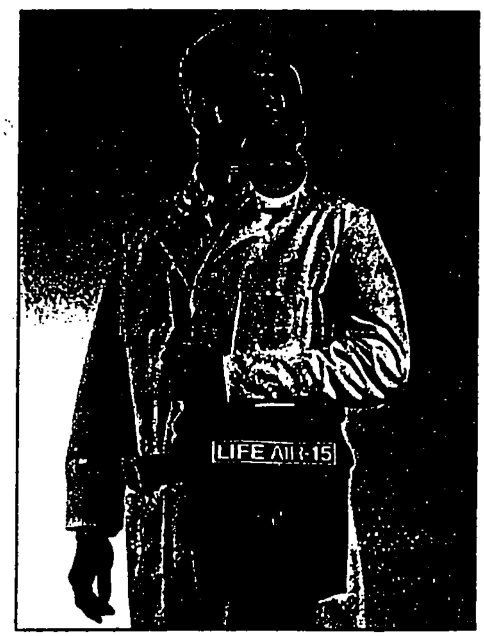
30/60 Minute Pressure Demand Air Mask

Positive pressure, 4500 psi air mask changes from a 30 minute to 60 minute unit simply by switching cylinders. Molded silicone faceplece seals comfortably to the face and won't stiffen in cold or soften in heat. Speaking diaphragm allows clear communications. Easy-on back pack harness securely holds lightweight aluminum-wrapped composite cylinders. Fully charged, the 30 and 60 minute units weigh 23- and 34-pounds, respectively. Includes low air warning and breakaway "D" rings for fast emergency release. NIOSH/MSHA approved. Training Video included with purchase.

No.	Type	Each
E-4293	60 Minute	2101.45
E-4278	30 Minute	1754.00
E-4295	60 Minute Spare Cylinder	746.50
E-4278-2	30 Minute Spare Cylinder	478.50

* LIFE AIR 5 OR 10





NORTH Emergency Escape Breathing Apparatus

When toxic gas or smoke makes breathing impossible, every second counts in helping your workers safely escape. All three North escape units help workers quickly and safely exit. Each features detachable polyurethane hood that slips on easily around neck for a secure fit and excellent visibility. Easy-to-use on/off valve with gauge immediately begins air flow and allows quick cylinder inspection. High visibility carrying bag with strap is instantly located in smokey environments. Tough molded case keeps unit protected and ready-to-use.

No.	Description	Each
E-9617	5 Minute/Moderate Exertion	239.50
E-9618	10 Minute/Longer Escape Route	289.20
E-9619	5 Minute/High Exertion	284.10

5/10 Minute Emergency Escape Units

Provides complete respiratory protection for escape from toxic atmospheres containing smoke, gases, mists or dusts, as well as oxygen deficient atmospheres. Aluminized hood can be easily donned and quickly adjusted for a proper fit, even if eyeglasses are worn. Lens allows wide visibility and is specially treated to eliminate fogging. Five minute unit has 8 ft³ of air at 2216 psig. Ten minute unit has 12 ft³ of air at 3000 psig. Optional adapter allows cylinders to be refilled at local dive shops. Harness assembly is made of 1½" nylon straps that can be worn around the neck, chest, shoulder or waist. Includes wall mountable storage case. NIOSH/MSHA approval No. TC-13F-179 (5 min.); TC-13F-178 (10 min.).

No.	Description	Wt. (Lbs.)	Each
E-6751	5 Minute Unit w/case	6	320.50
E-5900	10 Minute Unit w/case	4½	418.95
E-5901	Refill Hose Adapter		126.90

15 Minute Entry/ Supplied Air SCBA

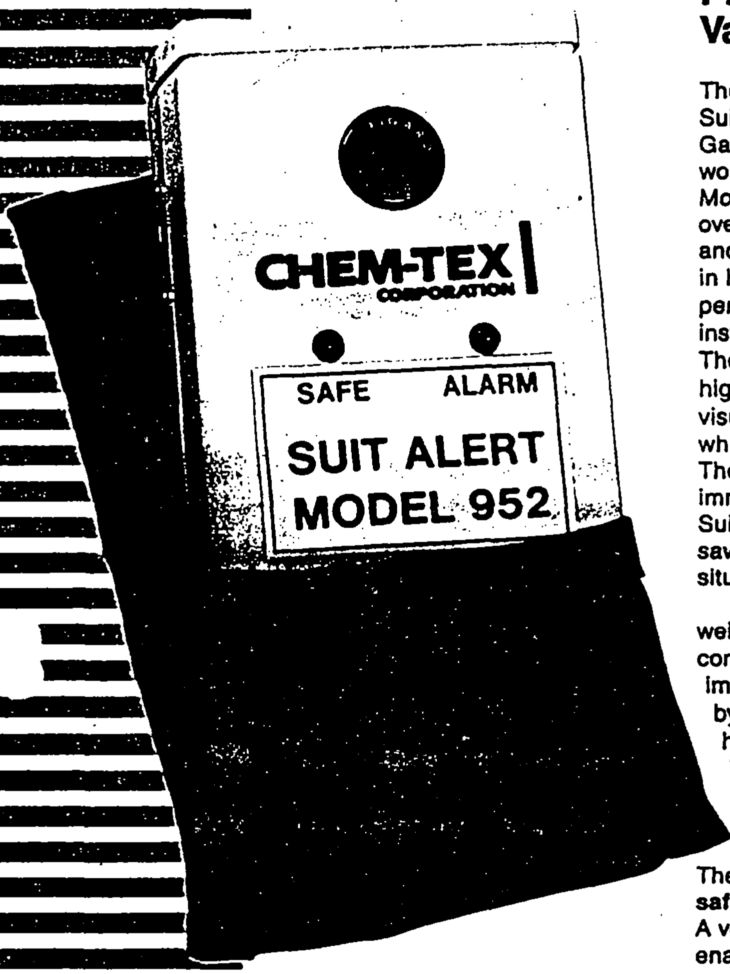
LIFEAIR™ 1500 supplies an average 15-18 minutes of respirable air, one-third more than most other entry SCBAs. For maximum mobility in confined places, the 1500 eliminates the stationary back pack and puts the air supply on the left hip. Simply adjust to the front or back side for tight maneuvering. Full face four point suspension facemask includes two adjustment straps for a secure, comfortable fit. Low profile unit weighs only 12 pounds fully charged and goes on and comes off easily in seconds. Features supplied air capability (3' supplied air hook-up is standard), a 2nd stage mask mounted regulator and automatic air shut-off. MSHA/NIOSH approved.

E-7935 .... 938.50

HAZ-MAT SUIT GAS DETECTOR

Suit Alert™

PATENT APPLIED FOR



Chem-Tex Model 952 Suit Alert™ and versatile carrying pouch.

Protective Clothing Vapor/Gas Alarm

The primary use of the Chem-Tex Suit Alert™ is as a Haz-Mat Suit Gas Detector. Designed to be worn under safety clothing, the Model #952 Suit Alert™ will detect over 100 toxic/combustible vapors and gases generally encountered in Haz-Mat situations. If gases penetrate the protective suit, the instrument will go into Gas Alarm. The alarm is signified by both a high audible pulsing buzzer and visually with a red alarm light which glows red when activated. The alarms alert the user to take immediate corrective action. The Suit Alert™ detection ability can save valuable time in critical situations.

The self-contained unit weighs only 12 ounces and is constructed of a durable, high impact plastic. Power is supplied by a 9V lithium battery, and has a low battery alarm. The Sensor is a solid state MOS that samples by continuous diffusion. Sensor life is 3-4 years. The Suit Alert™ is **intrinsically safe** for explosive atmospheres. A versatile carrying pouch enables the instrument to be worn under safety clothing on a belt, attached to straps of SCBA or attached to the inside of the garments. The unit may be used with Type I (Level A) or Type II (Level B) protective clothing.

Decontamination

The Suit Alert™ works well in DE-CON applications. It detects residuals of hazardous materials remaining on the outside of protective garments not properly removed in cleaning and decon procedures.

The Reusable protective garment specialists

CHEM-TEX CORPORATION

550 West Ingham Ave.
P.O. Box 5878
Trenton, NJ 08638
609-392-6770

Applications

The personal, compact size of the Suit Alert™ and the versatility of the carrying pouch enables the unit to be worn in a variety of situations:

- On a belt or the belt webbing of a SCBA.
- In pouch around the neck in the breathing area.
- Attached to adjustment straps of SCBA.
- Attached to the fabric of the suit using self adhesive velcro provided with pouch.
- A carrying pocket in breathing area can be built into total encapsulated (Level A) suits when manufactured by Chem-Tex.

Proper training with the Suit Alert™ will help you determine how to we the unit properly.

Early detection

In many emergency situations the extent of the hazardous gases are not known. The Suit Alert™ is excel t for helping to determine what typ of garment should be worn. If worn under Tyvek or Type II (Level B) clothing it will alarm if small concentrations of vapors or gases should penetrate the fabric. This would indicate that a different type of clothing should be worn. (Butyl, e)

Specifications

Housing:	High impact plastic
Dimensions:	$4\frac{3}{8}$" H x $1\frac{1}{16}$" W x $1\frac{5}{16}$" D
Weight:	12 ounces
Controls:	On-off slide switch (external) Sensitivity adjustment (internal)
Audible Alarm:	Pulsing (gas alarm) 97 DB-A Steady (low battery)
Visual Indicators:	Safe (green LED) Alarm (red LED)
Power Source:	9V lithium battery
Battery Life:	Two to three hours continuous
Sampling Method:	Continuous diffusion
Detector Type:	Solid state MOS

The Model 952 Suit Alert™ is intrinsically safe.

Will detect over 100 toxic combustible vapors & gases.

A PARTIAL LISTING OF GASES AND VAPORS DETECTED BY "SUIT ALERT"

- Acetone
- Acetylene
- Acrylates
- Acrylonitrile
- Aerosol Propellants
- Alcohol
- Ammonia
- Benzene
- Butane
- Butanol
- Butyrate
- n-Butyl Acetate
- Carbon Monoxide
- Carbon Tetrachloride
- Chlorine
- Chloroform
- Chloropicrine
- Cyclohexanone
- Dichloroethane
- Diesel Fuel Fumes
- Dimethyl Amine
- Epoxies
- Ethane
- Ethanol
- Ethylene
- Ethylene Oxide
- Fluorine
- Formaldehyde
- Freon
- Gasoline Fumes
- Halon
- Heptane
- Hexane
- Hydrogen.
- Hydrogen Chloride
- Hydrogen Cyanide
- Hydrogen Selenide
- Hydrogen Sulfide
- Isopropanol
- Kerosene Fumes
- Lacquer Thinner
- L.P. Gas
- Methane
- Methanol
- Methyl
- Methyl Acetate
- Methyl Bromide
- Methyl Cercaptan
- Methyl Chloride
- Methyl Ether
- MEK
- MIBK
- Methyl Mercap
- Methylene Chloride
- Naptha
- Natural Gas
- Pentane
- Perchloroethylene
- Propane
- Proprionate
- Styrene
- Sulfur Dioxide
- Terphenyls
- Toluene
- Toluene Diisocynate
- Trichloroethane
- Trichloroethylene
- Turpentine
- Vinyl Chloride
- Vinyl Toluene
- Xylene
- Xylol

Chemrel™ . . .

. . . provides exceptional protection against a variety of chemicals. Flexible laminate fabric features heat-sealed safety seams for strength and chemical protection almost equal to the Chemrel material itself. An ideal cost-effective choice for use in immediate response situations or providing reliable over-suit protection.

Total Body and All Purpose Coveralls

Roomy enough to slip on over work clothes, both styles feature zipper front with overflap. **Total Body Coverall** includes attached hood and boot covers. Please specify size: (L) (XL). ***All Purpose Coverall*** comes with shirt collar, elastic wrists and ankles. Please specify size: (L) (XL).

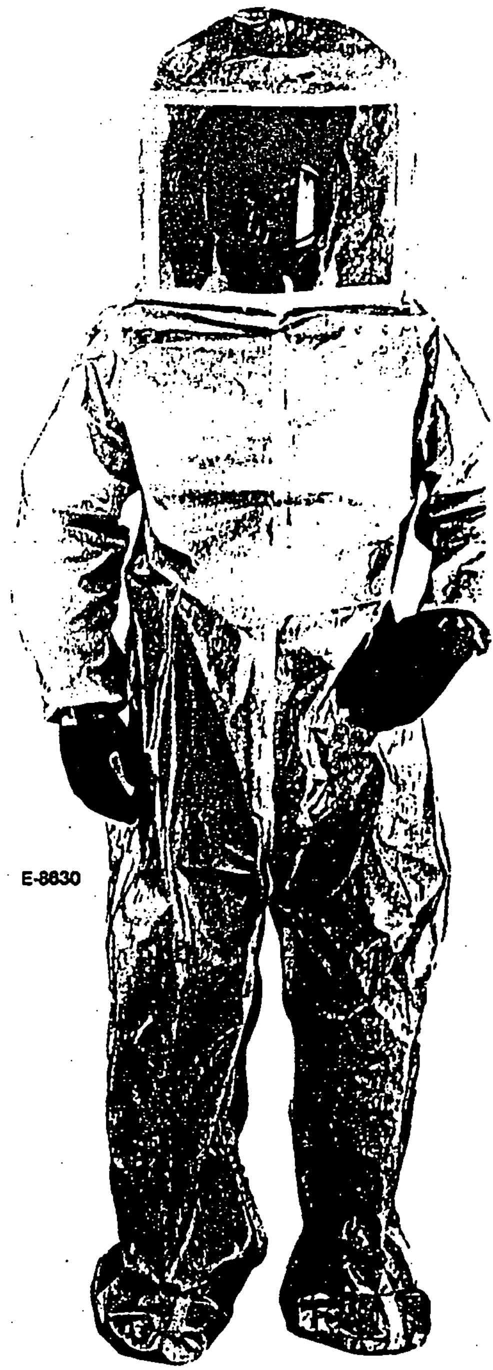
No.	Description	Each	Case of 10
E-8832	Total Body Coverall	39.50	354.00
E-8631	All Purpose Coverall	32.75	292.00

* CHEMREL C-106

Haz-Mat Suit

Affords superior chemical protection for response to haz-mat emergencies. Suit includes expanded back to fit a complete air pack, covered zipper, attached boots and a large FEP (Teflon fluorinated ethylene propylene) face mask for improved visibility and chemical resistance. Elasticized wrists. Please specify size: (L) (XL).

E-8630LE	Large	112.00
E-8630XLE	X-Large	124.00



E-8830

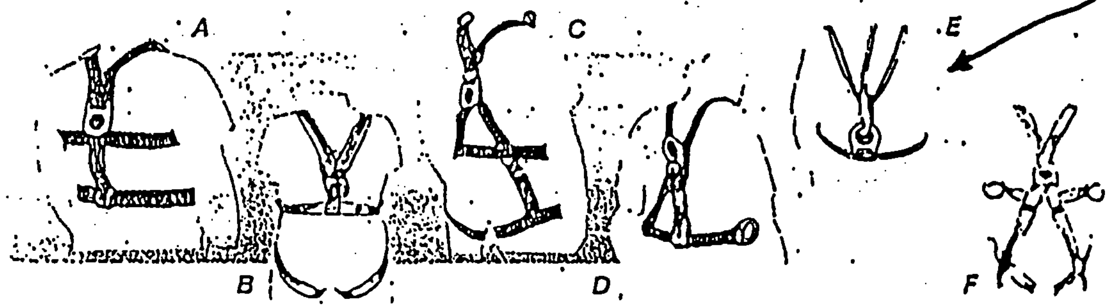
Protective Clothing Selection Guide

Chemical	Chemrel™ Breakthrough Time	Saranex® 23-P Film on Tyvek Breakthrough Time
[illegible]	[illegible]	[illegible]

> = Greater Than   < = Less Than

Safety Harnesses & Belts

HARNESS



All of the harnesses listed below meet OSHA requirements and the ANSI A10.14 1975 classification according to the service for which they are approved.

Class II chest harnesses are used where there are only limited fall hazards (no vertical free fall hazard) and for retrieval purposes, such as removal of a person from a tank or bin. These harnesses are not subject to impact requirements.

Class III harnesses are used to arrest the most severe free falls.

A Waist-Chester Safety Harnesses

Good all around harnesses for fall protection, positioning, lowering, and lifting. Weight is evenly distributed over the torso at all times, even during impact. Waist straps help keep body secure in a fall. Fit up to 47" waist size.

Available in 2" laminated nylon webbing or 1¾" polyester webbing for use in acid environments. Equipped with an adjustable single pass friction buckle and a drop forged steel D-ring positioned at center back. ANSI Class I and II rating.

Description	No.	NET EACH
Nylon Harness	7921T2	$61.60
Polyester Harness	7921T3	63.51

B Nylon Shoulder Harness

Body harness fits snugly around shoulders, waist, and legs. Made of 1¾" wide nylon webbing, latex treated to resist abrasion, moisture, and mildew. Three drop forged steel slide buckles permit easy adjustment for any size man. Buckles are located on each shoulder and at the waist.

Drop forged circle D-ring is at the center of the back for easy, but of the way lifeline attachment. Riveted and reinforced wear points for strength. ANSI Class III rating.

No. 8260T12 .... NET EACH $68.91

C Full Body Safety Harnesses

Recommended for use in severe fall hazard areas. Also can be used to lift or lower workers in rescue operations. Body restraint device effectively distributes fall impact force over thighs, buttocks, and shoulders. Adjustable harness is made of 2" wide nylon webbing with small D-rings at shoulders for lifting or lowering, and a large fall arresting D-ring at center of the back. Harnesses have an ANSI Class III rating.

Waist Size	No.	NET EACH
SINGLE PASS FRICTION BUCKLE		
Maximum of 56"	7942T14	$84.64
TONGUE BUCKLE		
32" to 41"	7942T16	$88.33
36" to 45"	7942T18	88.33
40" to 49"	7942T21	88.33

D Safety Rescue Chest Harnesses

Practical for use on swing stages with a lifeline or rope grab, and in enclosed places, such as quarries or tanks. Provide added safety for workers performing any job where it may be necessary to be lifted out in a hurry. Made of moisture resistant 1¾" wide orange nylon webbing. Harnesses have double pass friction buckles to fit waists size 36" to 44". No. 7940T1 adjusts by raising or lowering the circle D-ring through the loop at the back. No. 7940T2 has back and side D-rings, which offer additional stability. Both harnesses have an ANSI Class II rating.

Description	No.	NET EACH
Without Side D-rings	7940T1	$34.11
With Side D-rings	7940T2	71.71

E Nylon Chest Harness With Tail Line

Strong, multiple ply neoprene impregnated nylon support harness has 25 feet of ½" nylon filament rope tail line. Spliced to a drop forged circle D-ring at rear of support strap. Safety harness provides maximum protection and freedom of movement and is chemical and abrasive resistant. The 1¾" wide chest strap adjusts from 36" to 44". Adjustable shoulder straps are 1" wide. Waist belt has a single tongue type buckle. ANSI Class II rating.

No. 8226T14 .... NET EACH $84.51

F Universal Work Harness

Used for lowering and raising an inert body upright through narrow openings. Permits personnel to work at elevated levels or in tanks with complete freedom of movement. Designed so that the force of impact is taken on legs to prevent compression on the chest or abdomen in the event of a fall.

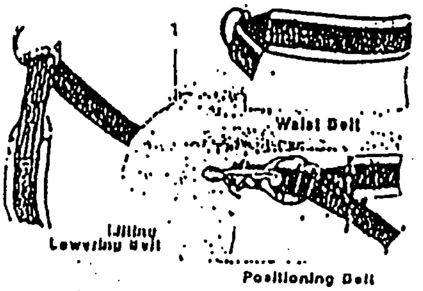
Complete body harness, with shoulder and leg supports, is made of 1¾" wide nylon webbing, resin, or latex treated for abrasion, moisture and mildew resistance. Three drop forged steel buckles permit easy adjustment for any size man.

Drop forged D-rings are located for convenient attachment of lifelines: one on each hip, and one at the center of the back. Solid copper rivets and burrs are hand set with leather washers for added strength and longer service life.

Harness has an ANSI Class III rating and State of California, Division of Industrial Safety Approval No. C-4317.

No. 7979T1 .... NET EACH $88.34

Multi-Purpose Safety Belts



Versatile belts serve as either waist, positioning, or lowering lifting belts. They permit workers to shift jobs quickly and easily by simply changing the position of the continuous loop rear strap. Worker can move from above or below ground horizontal work sites to steep sloping surfaces, or from lifting and lowering operations to vertical wall work.

Belts are 2" wide laminated nylon webbing with 3" body pads that pass through two fixed D-rings at hips. D-rings also serve as attachment points for positioning or arresting devices. Safety belts meet OSHA requirements and ANSI A10.14 1975 Class I and IV (for lifting/lowering only) standards.

SINGLE PASS FRICTION BUCKLE			TONGUE BUCKLE WITH BRASS GROMMETS		
Waist Size	No.	NET EACH	Waist Size	No.	NET EACH
32"-41"	7933T41	$46.98	32"-41"	7933T51	$45.44
36"-44"	7933T43	46.98	36"-45"	7933T54	45.44
			40"-49"	7933T55	45.44

McMASTER-CARR

B.) *Equipment inspection prior to use:*

1.) 3 M Hose Mask (White Cap):

a.) Helmet

- -check for cracks in the hardhat, face shield and breathing tube nipple.
- -check for holes or tears in the shroud.
- -inspect integrity of helmet suspension and then fit. (Refer to Illustration #1)
- -check visability through face shield. Clean if necessary.

Hood

- -Because these hoods are disposable use a new hood for every entry.
- -check hood and view opening for holes and tears.
- -check collar assembly and breathing tube nipple for cracks.

b.) Breathing Tube

- -check tube for cracks, deterioration or holes by pulling to increase length.
- -check the 2 fastners for reliability.
- -attach the breathing tube to the Helmet or Hood nipple and to the Air Regulating Valve Assembly with the 2 fastners.

c.) Air Regulating Valve Assembly

- -check for cracks in the housing.
- -check all connections and the spindle nut. (Refer to Illustration #2)

d.) High Pressure Hose

- -check for cracks, deterioration and holes.
- -check attachment to the outlet of the flowmeter.

e.) Flowmeter

- -check operator protection shield for cracks and visability.
- -check the integrity of the meter tube.
- -check the connection to and from the flowmeter. (Refer to Illustration #3)

ILLUSTRATION F-1

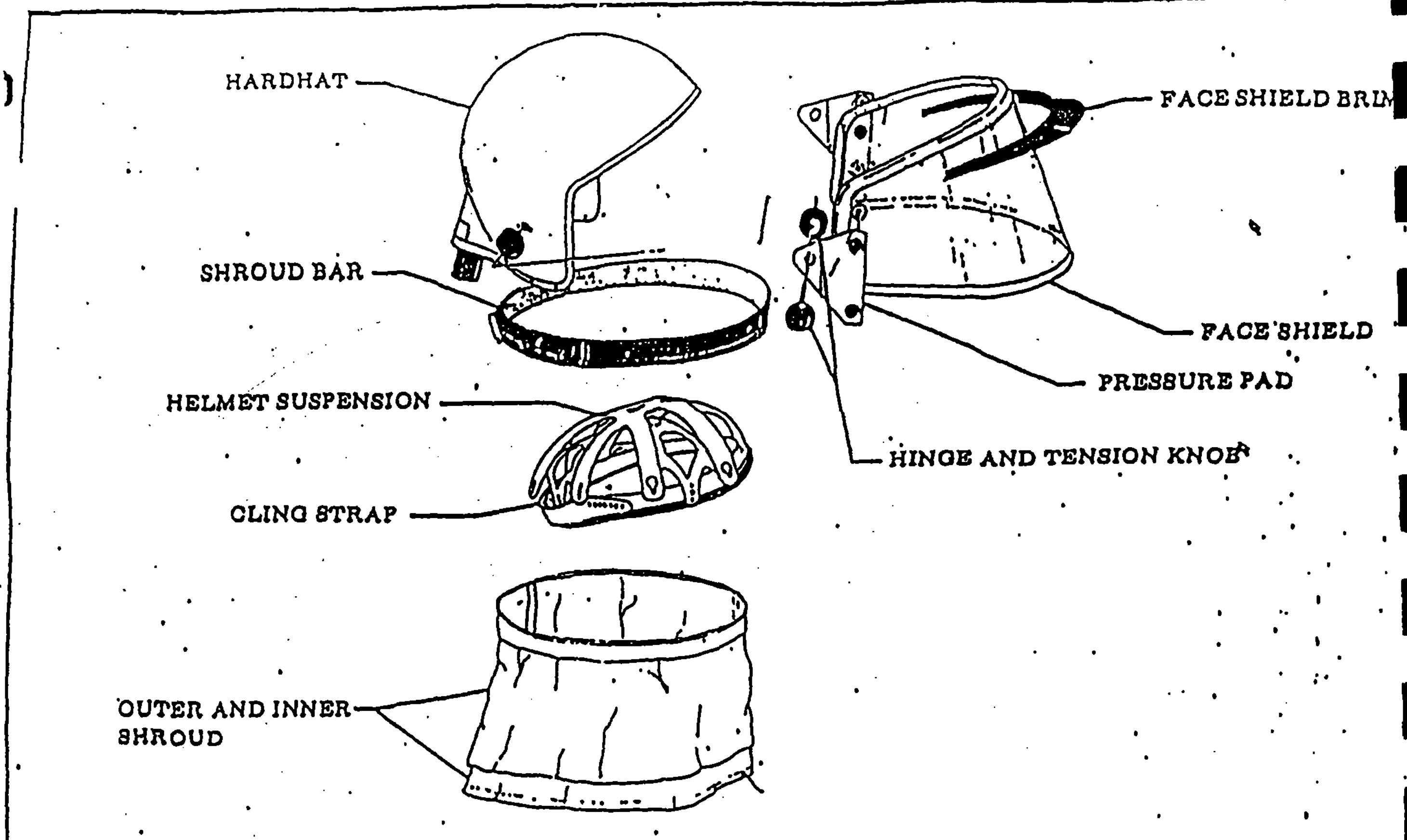


Figure 2-1. Whitecap Helmet Assembly

SECTION 2
GENERAL DESCRIPTION

2-1. GENERAL

The Model 5005AA Whitecap Helmet Assembly (figure 2-1) consists of a hardhat, liftable plastic faceshield, faceshield pressure pad, faceshield hinge and tension knob, faceshield brim, shroud bar, head suspension, cling strap, outer and inner shroud.

2-2. HARDHAT. The hardhat consists of an inner and outer shell which form a plenum chamber for air entering the inlet tube at the rear of the hardhat. Air outlets in the inner shell allow clean filtered air to enter the interior of the hardhat.

2-3. LIFTABLE PLASTIC FACESHIELD. The wide, clear faceshield can be flipped up and is attached to the helmet by the pressure pads and adjustable hinge tension knobs.

2-4. FACE SHIELD HINGE AND TENSION KNOB. The Faceshield Hinge and Tension Knob provides a means of attachment for the faceshield to the helmet through the p[illegible]re pad and allows the user to adjust the tension on the [illegible]p faceshield.

2-5. FACE SHIELD PRESSURE PAD. The Faceshield Pressure Pad provides a means of attachment and support for [illegible] clear plastic faceshield.

2-6. FACE SHIELD BRIM. The Faceshield Brim provides [illegible] means of support and curvature of the faceshield and a hand[illegible] for lifting up the faceshield.

2-7. SHROUD BAR. The Shroud Bar provides attachme[illegible] points for the inner and outer shroud and helps to maintain [illegible] seal between faceshield and shroud bar.

2-8. HELMET SUSPENSION. The Helmet Suspensio[illegible] provides hardhat protection with a minimum safe clearan[illegible] between helmet shell and head. An adjustable headband is attached to the helmet suspension.

2-9. CLING STRAP. The adjustable padded plastic clin[illegible] strap eliminates the need for a chin strap in most cases except where excessive head movement is a job requirement.

2-10. OUTER AND INNER SHROUD. The outer shroud and inner shroud are secured at the upper end with 3M Brand SCOTCHMATE®. They can be separated by pulling apart. Both outer and inner shroud are secured to the inside of the shroud bar. Inner shroud has a pull string for snug fit and should be worn inside of shirt.

ILLUSTRATION #2

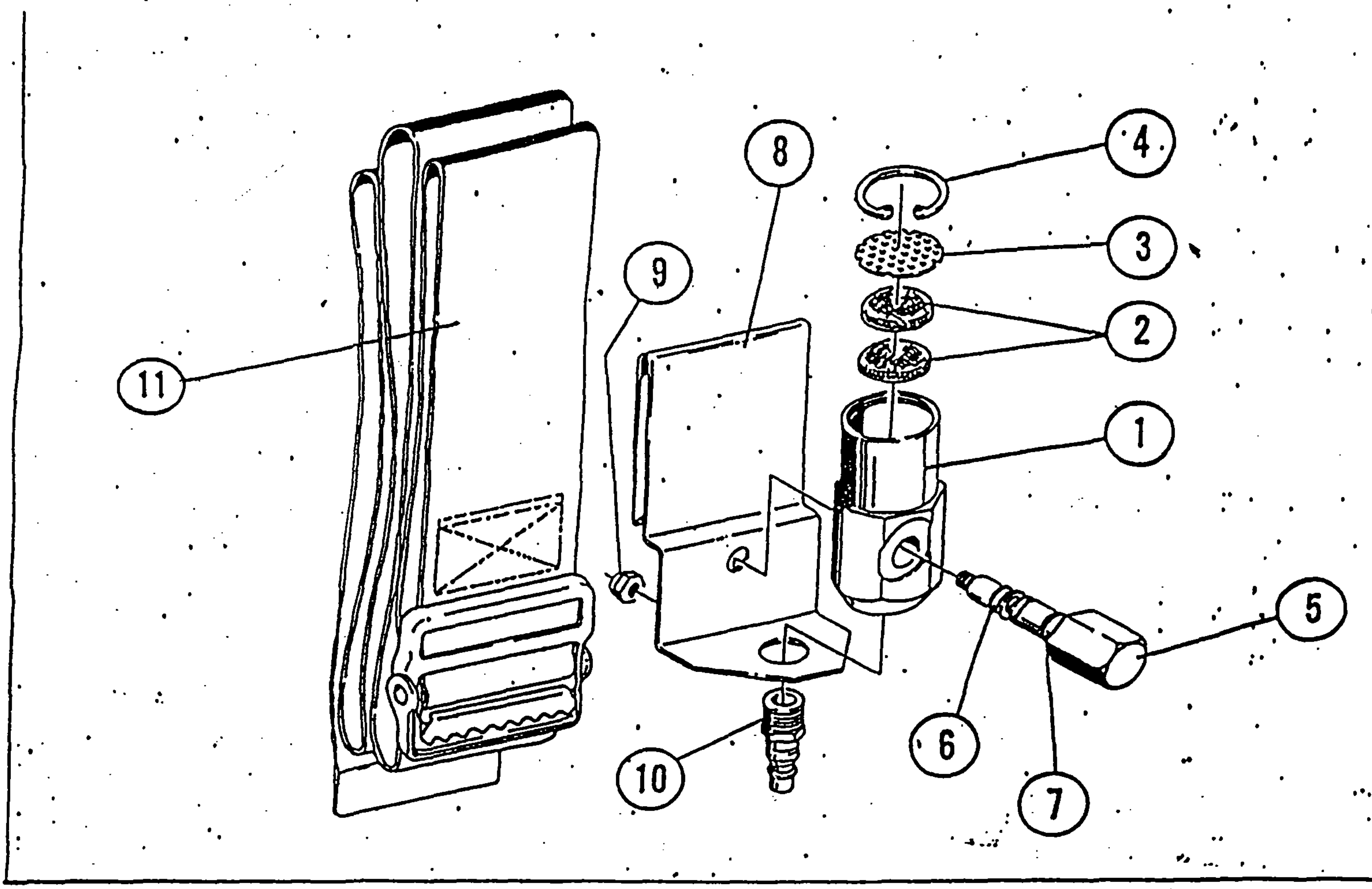


Figure 4.1 W-2907 Air Regulating Valve — Assembly

Item Number	Item Number	Identification	Qty. Req.
1	78-8014-3354-7	Housing (W-2898)	1
2	78-8014-3235-8	Disc (W-2892)	2
3	78-8014-3262-3	Screen (W-2894)	1
4	26-1001-2644-5	Retaining Ring (W-2893)	1
5	78-8014-3355-4	Spindle (W-2895)	1
6	78-8002-2525-8	O-Ring (W-2897)	1
	26-0001-1100-0	O-Ring (W-2896)	1
	78-8014-3353-9	Holder (W-2911)	1
9	18-1755-2703-7	Nut (W-2910)	1
10	78-8032-0828-5	Plug-Quick Disconnect (W-1279)	1
11	78-8007-5233-5	Belt, Waist (W-6896)	1

ILLUSTRATION #3

ting. Rotate the tube as required to make the etched scale visible. Make certain that the tube is firmly sealed on the inlet fitting tube rest gasket.

4) Replace the drain plug and operator protection shield to complete the installation.

WARNING

Operation of the meter without the operator protection shield in place may result in operator bodily injury.

V. Disassembly

To completely disassemble the meter, disconnect the process piping; remove the meter from the panel or other support. Refer to Figure 10, an exploded view of the meter, and proceed as follows:

1) Remove the tube and float as discussed in Part II, preceding.

2) Loosen and remove the two set screws that hold each end fitting to the frame. Pull the fittings from the frame.

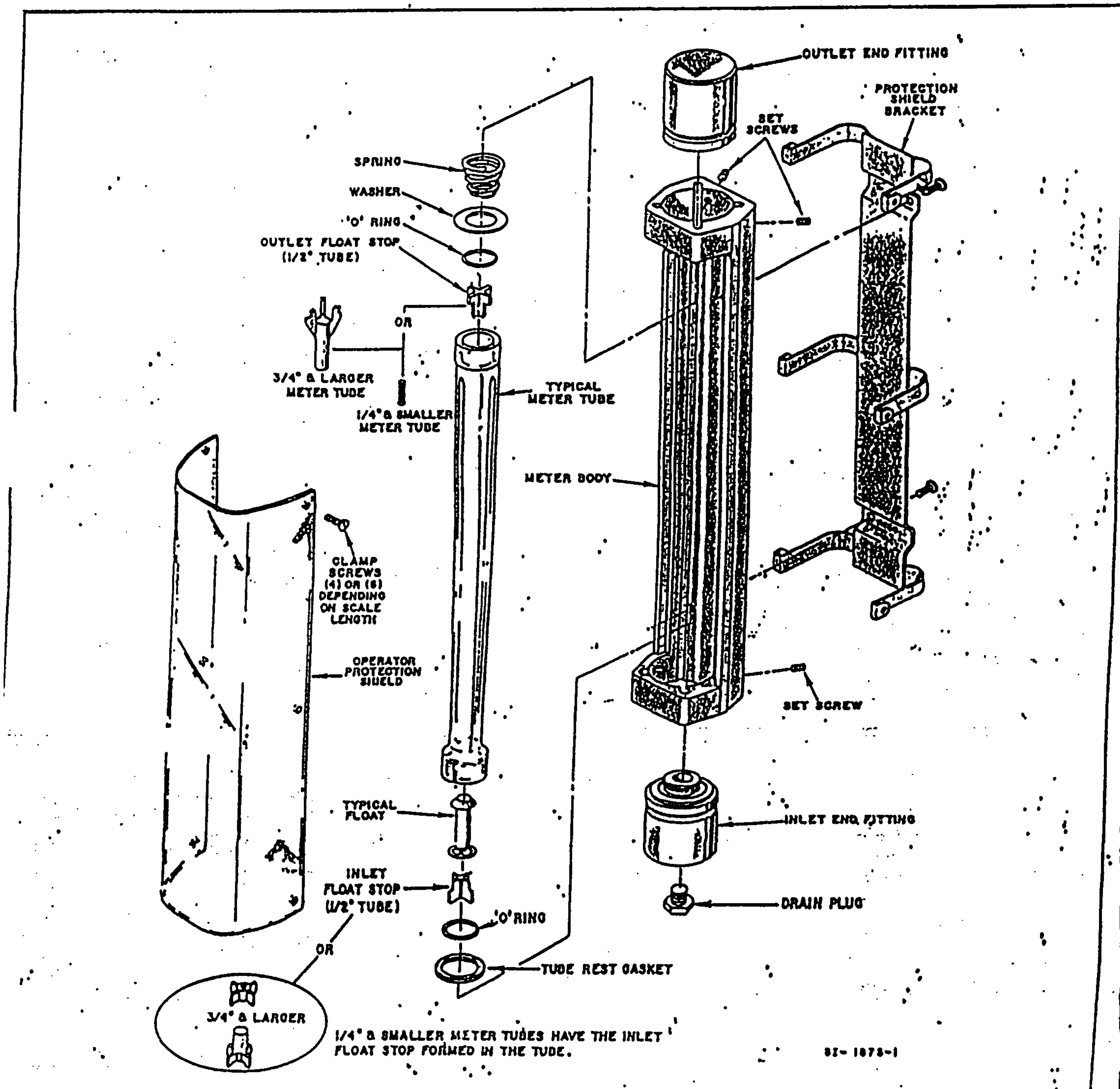


FIGURE 10 EXPLODED VIEW OF METER (1/2" x 1/2" SIZE ILLUSTRATED)

f.) Pressure regulator w/Hose-

- -check for cracks, deterioration and holes in the hose.
- -check hose connection to the regulator.
- -check operation of the regulator adjustment nob. (leave nob turned out)
- -check regulator attachment to the breathing air cylinder.

g.) Breathing Air Cylinders-

- -check pressure on both cylinders by attaching the regulator and opening cylinder valve. A Full cylinder should read 2200#. Do not use a cylinder read below 400#.
- -reattach regulator to the first cylinder.

2.) MSA Air Mask (SCBA):

a.) Mask Assembly-

- -check for contamination, damage and deterioration.
- -check visability and clean if necessary.
- -fit the mask and check for air leaks by closing off the inlet of the Breathing Tube,

b.) Breathing Tube-

- -check for cracks, deterioration and holes by streching the tube length.
- -check the connection to the mask.

c.) Regulator Assembly-

- -inspect for surface damage and deterioration of the assembly and high pressure hose.
- -with mask and breathing tube attached open main line (yellow) and cylinder valve to pressurize the regulator and hose. Close the cylinder valve, watch the regulator gage for a drop in the reading (leak indication). Breathe unit down until the Audi-Larm rings. Check the regulator gage for the pressure (alarm should ring at about ¼ full pressure or 550#). With the cylinder valve closed, breath out the remaining pressure.

d.) Air Tank-

-Check the tank pressure. 2200# is full and will give approximately 30 minutes of air. Do not use a cylinder below 500#.
-check the Harness for wear and function of the hardware.
-fit the harness.

e.) Emergency Horn-

-check sound by depressing button for a short burst.

3.) LIFE AIR 5 Emergency Breathing System:

a.) Check the following parts for deterioration or cracks:

i.) Plastic hood with draw string around the bottom.
ii.) Plastic air hose from the tank to the plastic hood.
iii.) Carrying pouch with shoulder strap.

b.) Check regulator assembly and make sure the tank is full of air - gauge in the green.

4.) ARAP w/Escape:

a.) Mask Assembly-

-check for contamination, damage and deterioration.
-check visability and clean if necessary.
-check face mask leakage.
-check operation of the demand valve.

b.) Demand Hose-

-check for cracks, deterioration and holes.
-check the connection to the demand valve and reducing valve assembly.

c.) Escape Cylinder-

-check the tank pressure 2216 psig is full and will give approximately <u>5 minutes</u> to escape.
-check the harness for wear and function of the hardware.
-fit the harness.

5.) Suit Alert Model 952:

The Model #952 SUIT ALERT requires very little maintenance, usually battery change, and calibration and alarm adjustment.

a.) To change the battery, slide open the battery access door, allow the battery to fall out and remove the connector. Connect a fresh battery, insert it into the battery cavity and replace the access door.

b.) To calibrate and alarm adjust:

1. First open the instrument by removing the holding screws and separating the halves.

2. Turn instrument ON and allow it to warm up for 10 minutes.

3. Locate the potentiometer at the center, just above the battery.

4. Expose the sensor to a <u>known</u> concentration of the desired calibration gas, then rotate the potentiometer until the alarm just starts, no further. Repeat as necessary.

5. When the alarm is set, remove the calibration gas and verify that the alarm stops. Allow at least one minute.

6. Apply the calibration gas again to verify the alarm. Remove the gas.

7. Turn instrument OFF and reassemble the two halves, securing them with the four holding screws.

8. The instrument is now ready for use.

6.) Chemrel Haz Mat Suit C-106

-Check the entire suit for tears and/or puncture holes.
-check the visability of the face lense. Clean if necessary.
-inspect the operation of the zipper.

7.) Harness-

-prior to each use, carefully inspect the harness and securing lanyard for indication of wear or deterioration.
-check for loose threads, pulled rivet cuts, abrasion or evidence of chemical or physical exposure that may have weakened the material or assembly.
-untangle the lanyard and fit the harness.

C.) Procedure for entering a hazardous atmosphere:

1.) Scheduled Maintenance - All scheduled entries must be approved by the Site Safety and Health Officer prior to the following steps:

A.) Obtain an approved Hazardous Atmosphere Entry Form from the Site Safety and Health Officer.

B.) Secure equipment and begin Prior Equipment Checkout and record.

C.) Inform the responsible supervisor that entry is ready. Fit the required equipment and rehearse hand signals.

D.) Record the time and enter the atmosphere. Check the internals for impending dangers.

E.) Backup man will constantly observe the entry man(with conversation), flow settings, pressure settings, non foweling of harness lanyard and air hose and assist.

F.) If an emergency should arise during an entry the following steps should be taken by the back-up man:

a.) Signal the entry man to vacate the hazardous atmosphere. This can be done by verbal or hand communication, pulling on the harness lanyard or blasting the emergency horn.

b.) Assist in the entry man evacuation.

c.) If the entry man is immobile, attempt to pull the man to the fresh air opening with the harness lanyard(make sure not to fowel the air hose). Move the entry man's head to the fresh air and signal with the Emergency Horn for assistance.

d.) If the immobilized man cannot be pulled with the harness lanyard, the backup man must enter the tank. Sound an emergency with the horn, fit the air mask (SCBA), open cylinder valve, and enter the tank. Upon reaching the entry man move him to the fresh air opening and wait for assistance.

G.) During maintenance activities if it is necessary to switch the breathing air cylinder on the Hose Mask System, or ARAP, the entry man must evacuate the hazardous atmosphere.

H.) Upon completion of the scheduled maintenance and evacuation of the hazardous atmosphere, record information on the Hazardous Atmosphere Entry Form and begin after use equipment inspection.

2.) Rescue -Entry into a hazardous atmosphere for rescue purposes will in most cases will be time dependant. If time allows the same steps outlined in the scheduled maintenance entry will be followed. Variation will be allowed in order to speed up the rescue operations. The fastest rescue operation can be performed using the LIFE AIR 5 or 10 but only by a trained person. If entry is made with the LIFE AIR 5 or 10 without backup assistance try to signal with the Emergency Horn.

3.) Use of the LIFE AIR 5 or 10 system is as follows:

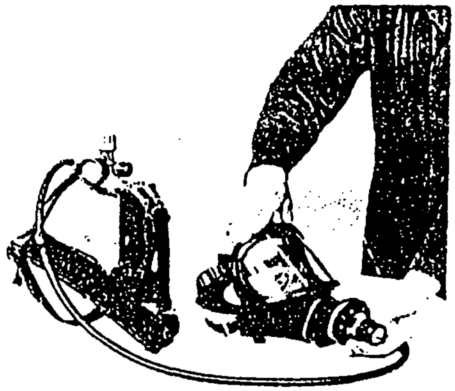
1.) Take the unit and go as close as possible to the hazardous atmosphere then remove the unit from the hard shell case and perform the pre-use inspection.
2.) Place the shoulder strap over your head.
3.) Remove the hood from the pouch and insure the air hose is free of kinks, knots and place over your head.
4.) Pull the draw string as tight as possible.
5.) Open the valve fully on the regulator.
6.) Insure a full air flow.
7.) Let air tank hang from your shoulder.
8.) Remember you have only 5 or 10 minutes of air.

4.) Use of the ARAP w/Escape:

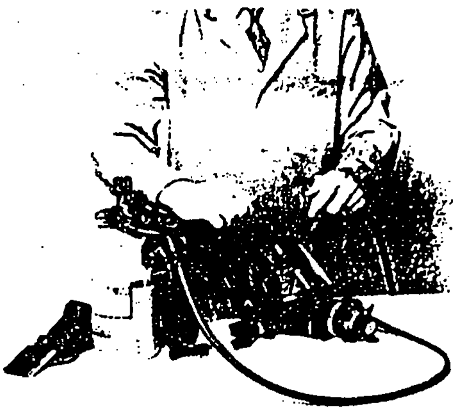
DONNING AND OPERATING INSTRUCTIONS

IMPORTANT: THE EQUIPMENT MUST NOT BE USED UNLESS IT HAS BEEN SERVICED IN ACCORDANCE WITH THIS HANDBOOK.

1. BEFORE ENTERING WORK AREA
Lift and turn OFF the black safety pressure knob on the demand valve.



2. CONNECT SUPPLIED AIRLINE



3. PUT ON APPARATUS

Ensure that the shoulder strap and waist belt are fully slackened.

Put on the apparatus and adjust the shoulder strap until the cylinder is held snugly at the waist. Fit waist belt and adjust as required.

Hang facepiece strap around neck. With thumbs inside head harness straps, put chin into mask first and pull straps over head.

Position mask so that chin fits snugly into chin-cup and then gently tighten head harness, lower straps first. Do not over tighten.

4. CHECK POSITIVE PRESSURE

Turn black knob on demand valve to the ON position.

Gently lift mask seal off the cheek and ensure that air flows freely out of the mask, *proving that the air pressure in the mask is* positive.

Next, hold breath. There shall be no outward leakage from the exhale valve as denoted by the noise of a constant flow of air from the demand valve.

5. CHECK FACE MASK LEAKAGE
Turn OFF air supply and continue to breathe normally until air in apparatus is exhausted and the facepiece is pulled gently onto the face. When gauge shows zero, hold breath for 10 seconds; any leakage will either be heard or shown by the mask moving away from the face. If leak is detected, turn on cylinder valve, re-adjust mask and head harness, and re-test.

6. SUPPLIED AIRLINE RESPIRATOR
When supplied airline respirator, SAR, is in use the cylinder valve red knob must be closed.

IF ANY ONE OF THE ABOVE TESTS FAILS, RETURN THE APPARATUS FOR SERVICING. MAKE A NOTE OF FAULT AND ATTACH TO APPARATUS.

EMERGENCY EGRESS UNIT

The apparatus is supplied with an egress unit which in the event of a failure of air supply will give the wearer approximately 5 minutes of air.

The apparatus can be used by simply turning on the red ON/OFF knob this action will ensure air to the facepiece.

Disconnect the supplied airline hose at the quick coupling and exit to a safe area.

AFTER USE INSTRUCTIONS

Warning: Equipment should not be removed until the wearer is clear of the hazard area.

1. Lift and turn OFF the safety pressure demand valve switch.
2. Slacken off head harness and remove facepiece.
3. Turn off cylinder valve if egress unit has been used.
4. Slacken off shoulder strap and undo waist belt.
5. Take off apparatus.

AFTER USE CLEANING AND TESTING

Warning: Do not immerse pressure gauge or demand valve in water.

1. CLEAN FACEPIECE
   a.) Unscrew demand valve from facepiece. Wash mask in cool warm soapy water. Use toliet soap-not detergent. Rinse thoroughly in clean running water.
   b.) After washing, shake to remove excess water and allow to dry away from direct heat or sunlight. Do not place facepiece 'visor down' on rough surfaces as the visor may become scratched.

Warning: If the apparatus is likely to be stored at temperatures below freezing point 0 C, the facepiece must be thoroughly dried and finally lightly dusted with french chalk, paying particular attention to the valves.

c.) When dry, polish the visor inside and out with a clean lint free cloth. The inside may be wiped with a suitable de-misting agent.
d.) Replace the mask ensuring that the demand valve is tightened with the supply hose fitted to pass over the right shoulder.
e.) Ensure head harness is fully slackened ready to put on.

2. CLEAN APPARATUS

Fully slacken shoulder strap and waistbelt. Clean off any dirt with a stiff brush or sponge. Check pressure gauge glass is clean.

3. REPLACE FULL CYLINDER

4. LEAK TEST OF APPARATUS
Ensure demand valve is in OFF position.
Open cylinder valve slowly and close again.
a.) Check that there is no audible leak from demand valve.
b.) Test all joints with soap and water bubble solution.

Warning: Do not try to cure leaks by overtightening joints.

5. CHECK POSITIVE PRESSURE

a.) Open cylinder valve and put on facepiece. Breathe gently for half a minute and then switch demand valve to ON position.
b.) Gently lift mask seal off the cheek and ensure that air flows freely out of the mask, proving that the air pressure in the mask is positive.
c.) Allow mask to reseal and hold breath. There shall be no outward leakage from the exhale valve as denoted by the noise of a constant flow of air from the demand valve. Switch demand valve to OFF position.

6. RE-CHECK CYLINDER PRESSURE
Re-check that cylinder is full, close cylinder valve, switch demand valve to ON position to release air trapped in system. Switch demand valve to OFF position and store apparatus ready for use.

NOTE: The equipment should be stored in a dry area free from direct sunlight and extremes of temperature.

5.) Suit Alert Model 952 Use:

The Model #952 Suit Alert is an early warning detector that will respond to low level concentrations of various combustible/toxic gases and vapors.

1. Turn instrument ON in a fresh-air environment by pushing the slide switch upward. The green SAFE light will glow. The buzzer will sound and the red ALARM light will glow in an alarm state during the sensor warm-up period. This indicates that both lights and the audible alarm are functioning properly. This initial warm up period should last about one minute. <u>NOTE</u>: If the Model #952 has <u>not</u> been used for several days this sensor warm-up alarm period may last longer. When the sensor is ready, the buzzer will stop and the RED ALARM light will go out. The green SAFE light will continue to glow. IF THE BUZZER CONTINUES TO SOUND <u>AFTER</u> THE RED ALARM LIGHT HAS GONE OUT AND THE GREEN LIGHT IS STILL ON, IT INDICATES LOW BATTERY ALARM. THIS DIFFERS FROM THE GAS ALARM IN THAT THE RED ALARM LIGHT WILL BE OFF WHEN THE BUZZER SOUNDS SEE BELOW.

2. Place the instrument in the pouch with the sensor facing out. The pouch may be worn around the neck with the pouch lanyard (in the breathing zone). It may be clipped to the front straps of a self contained breathing apparatus, attached to a waist belt with the pouch strap, or mounted inside a protective suit using the self adhesive Velcro on the back of the pouch. Proper training will determine the best location to wear the Model #952. NOTE: If attached inside a suit with Velcro, the fabric surface should be cleaned to provide better adhesion.

3. Don the protective garment allowing the face of the sensor to be exposed to the atmosphere within the suit. Avoid covering the sensor face.

4. If for any reason combustible/toxic gases or vapors penetrate the protective clothing at a concentration above the alarm level, the SUIT ALERT will go into gas alarm. Alarm is signified by both the buzzer sounding and the red alarm light glowing continuously.

5. The instrument is calibrated at the factory to go into alarm when a concentration of 20 ppm of benzene is reached or exceeded. The alarm will stop when the concentration falls below 20 ppm. The alarm is adjustable and can be calibrated to a <u>known</u> concentration of most combustible/ toxic gases. See Section III for calibration instructions.

6. When the battery voltage falls below 7.0V the buzzer will sound a continuous tone low battery alarm. This differs from the gas alarm in that the red ALARM light will be off when the buzzer sounds. The battery is accessible through a slide-away, removable door on the lower back side. The SUIT ALERT is powered by a 9.0V Lithium battery. The expected life of the battery when used <u>CONTINUOUSLY</u> is 3 - 4 hours. NOTE: In cold climates, allow the Lithium batteries a few more minutes for sensor warm-up. It is

recommended that the SUIT ALERT be stored over night in an area above 32 F. It is also recommended that an extra 9.0V battery always be kept with the SUIT ALERT. Use a fresh Alkaline or Lithium transistor type. Alkaline batteries will provide about a 1½ hour CONTINUOUS operation.

6.) Chemrel Haz Mat Suit use:

1.) If this suit is used with the 3M Hose Mask (White Cap) or the ARAP w/Escape, the Chemrel Haz Mat Suit is fitted first then the air apparatus.
2.) If this suit is used with the MSA Air Mask (SCBA), the air mask and assemble is fitted first then the Chemrel Haz Mat Suit.
3.) When the suit is being fitted care should be taken not to tear, rip or puncture the suit.
4.) The suit should be closed only when the air apparatus has been activated.
5.) Additional protective equipment or closures may be prescribed by the Site Safety and Health Officer.
6.) The suit should be opened any time the air supply is being changed.

D.) Decontamination procedure after the completion of the hazardous atmosphere entry:

1.) Deposit equipment (shovels, rakes, etc.) used at the location of the operation.
2.) Clean off equipment and put contaminated solids into the selected hazardous waste containers.
3.) Clean off boots, gloves and poly coated protective suit and put contaminated solids into the selected hazardous waste containers.
4.) Close the hazardous waste containers.
5.) Remove the protective boots, the gloves and then the air support mask.
6.) Remove the poly coated protective suit by rolling inside out downward and deposit in the proper container.
7.) Wash hands and face thoroughly before eating or drinking.

E.) Equipment inspections after use:

1.) Turn off all Cylinder valves.
2.) Surface clean equipment.
3.) Inspect all hoses for cuts, abrasions and cracks.
4.) Disinfect masks and inspect.
5.) Return all harnesses to full size.
6.) Return hose mask regulator nob to full out position.
7.) Disassemble Hose Mask Assemble.
8.) Disassemble Air Mask Assembly.
9.) Repackage all equipment.
10.) Return empty cylinders to MT cylinder stand at the storeroom and replace with full cylinders on the cart.

11.) Store equipment in proper locations:

- a.) 3M Hose Mask Assembly in Southeast corner of Reclaim Building.
- b.) 3M Hose Mask (White Cap) and breathing tube in Maintenance office.
- c.) MSA Air Mask (SCBA) in Maintenance office.
- d.) LIFE AIR 5 or 10 to Maintenance Office for refill or previous location.
- e.) ARAP w/Escape in Maintenance office NOTE - Inform Site Safety and Health Officer if the Escape Cylinder red ON/OFF knob was opened.
- f.) Suit Alert Model 952 in Maintenance office.
- g.) Chemrel Haz Mat Suit C-106. Follow proper decontamination procedures.
- h.) Harness in Maintenance office.

12.) Complete Hazardous Atmosphere Entry Form and return to responsible supervisor.

13.) Tag usable Breathing Air Cylinders with remaining pressure if not full.

14.) Report any equipment malfunctions to the responsible supervisor.

SITE SAFETY AND HEALTH OFFICER CHECKLIST

A.) Date:

B.) Description of Entry and Purpose:

C.) Toxicity Levels: (Based on last materials in space)

Substance	TWA	STEL

Reference 29 CFR Part 1910 Sub Part Z

D.) Last Material in the space ____________________
Run short duration toxic tube for toxic substances ____, ____ppm
____, ____ppm

E.) Oxygen Deficiency Levels: (Below 19.5%)

F.) Combustion Levels: (Above 22% LEL)

G.) Electrical switch gear: (Main shutoff and locked out)

H.) Nitrogen purge: (Disconnect Piping or Tubing)

I.) Lighting: (is it adequate and if not use explosion proof lamp)

J.) Temperature of the Atmosphere: (Below 100°F)

K.) Support tools to be used: (Sparkproof)

L.) Has the entry Personnel received Hazardous Atmosphere Entry Training? YES NO
If NO, the Personnel must be replaced.

M.) Errant Liquid or Gas entry: (Disconnect Piping or lock valves)

N.) Supervisor in charge:

O.) Issue Hazardous Atmosphere Entry Form:

P.) Review Hazardous Atmosphere Entry Form and brief workers of the potential hazards.

Q.) Signals:

1.) THUMB UP - OK
2.) THUMB DOWN - NOT OK
3.) BOTH HANDS CROSSED ON THE CHEST - NEED MORE AIR
4.) POINT DOWN - INSIDE MAN NEEDS ASSISTANCE
5.) HORN BLAST - INSIDE MAN MUST EVACUATE

R.) Signoff:

____________________ ____________
Site Safety and Health Officer Date

HAZARDOUS ATMOSPHERE ENTRY FORM
FOR SCHEDULED ENTRIES

1.) Date:
2.) Entry Description and Purpose:
3.) Plant Manager Approval:
4.) Equipment to be used:

3 M Hose Mask (White Cap)____________
MSA Air Mask (SCBA)____________
ARAP w/Escape____________
Suit Alert____________
Chemrel C-106____________
Harness____________
#5414 Poly Coated Tyvek Coveralls____________
SF 8512 Gaunt Vinyl Gloves____________
Lineman's Rubber Boots____________
Fire Extinguisher 20# Dry Chemical____________
Sparkproof Support Tools____________
Air Horn____________

5.) Entry Personnel:

Entry Man____________
Backup Man____________

6.) Time of entry:
7.) Time of completion:
8.) Checklist:

ITEM	ACTION	INITIAL
A.) Prior equipment inspection		
B.) Breathing Air Cylinder Pressure #1		
Breathing Air Cylinder Pressure #2		
C.) Prior Air Mask (SCBA) Cylinder Pressure		
D.) Prior ARAP Escape Cylinder Pressure		
E.) Hose Mask (White Cap) Regulator Setting (20-30 psi)		
F.) Hose Mask (White Cap) Flowmeter Setting (30%)		
G.) ARAP Hose Mask Pressure Setting (80 to 100 psi)		
H.) After use Equipment Inspection		
I.) After Breathing Air Cylinder Pressure #1		
After Breathing Air Cylinder Pressure #2		
J.) After Air Mask (SCBA) Cylinder Pressure		
K.) After ARAP Escape Cylinder Pressure		

9.) Equipment Problems or Comments:

Return to Site Safety and Health Officer

HAZARDOUS ATMOSPHERE ENTRY

TRAINING SCHEDULE

DATE	EMPLOYEE	DESCRIPTION OF TRAINING	EMPLOYEE SIGNATURE

OUTLINE FOR ANNUAL FIRE FIGHTING TRAINING

1. Purpose

   To familiarize the plant personel with the fire fighting equipment and the procedures to be used in case of a fire.

2. Read the Fire Emergency Action Plan.
3. Inform personel of the locations of the fire fighting equipment by use of fire prevention plan.
4. Demonstrate fire fighting techniques:
   - A.) Distance
   - B.) Location (Upwind and Access)
   - C.) Direction of spray
   - D.) Electrical Dangers
   - E.) Tankage Dangers
5. Demonstrate fire fighting equipment:
   - A.) Hand extinguishers (Dry chemical)
   - B.) 150# Wheel extinguishers (Dry chemical)
   - C.) Foam Unit
   - D.) Deluge units (Epoxol & Reclaim)
6. Questions and signout.

Reviewed: November 1989

AMERICAN CHEMICAL SERVICE

FIRE EMERGENCY ACTION PLAN

1. Purpose

To outline an emergency plan and procedures for responding to situations resulting from a fire in the work place. The primary purpose of this plan is to prevent injury to personnel and to limit the damage to property.

2. A) During A Shift (8:00 AM to 4:30 PM) the following procedures must be followed in the event of a fire:

1.) Upon discovery of a fire the person should immediately DIAL 71 on the intercom phone, attack the fire using dry chemical extinguishers or foam hose units and attempt to put the fire out. If the fire is extinguished or if the fire cannot be controlled immediately contact the Emergency Coordinator (622 or 624) or dial 600 or 601 on the intercom and give the exact location of the fire.

2.) The Emergency Coordinator will be responsible for notifying the fire department (924-3151), forming a fire fighting crew, and dispatching a person to meet the fire department at the main gate for directions.

3.) At the fire location all persons other than the fire fighters should begin backup operations as directed by the Emergency Coordinator:

a.) Turning off electrical equipment in the fire location.

b.) Informing personnel in adjacent operating facilities of the impending danger so standby or shutdown procedures can begin.

c.) Taking a head count of employees to determine that all are accounted for.

ANNUAL FIRE FIGHTING TRAINING

Date:__________________ Location__________________________

Attended by:___________ Conducted by:_____________________

Name (Printed)	Signature

B.) *During B & C shifts (4:31 PM to 7:59 AM) the following procedure must be followed in the case of a fire:*

1.) Upon discovery of the fire the person should immediately DIAL 71 on the intercom phone, attack the fire using dry chemical extinguishers or foam hose units and attempt to put the fire out. If the person extinguishes the fire himself, he should check the area for further indications of fire and when satisfied that the danger is passed, call the Emergency Coordinator (838-2929 or 365-3763) or call the beeper members (755-2472 or 755-2519).

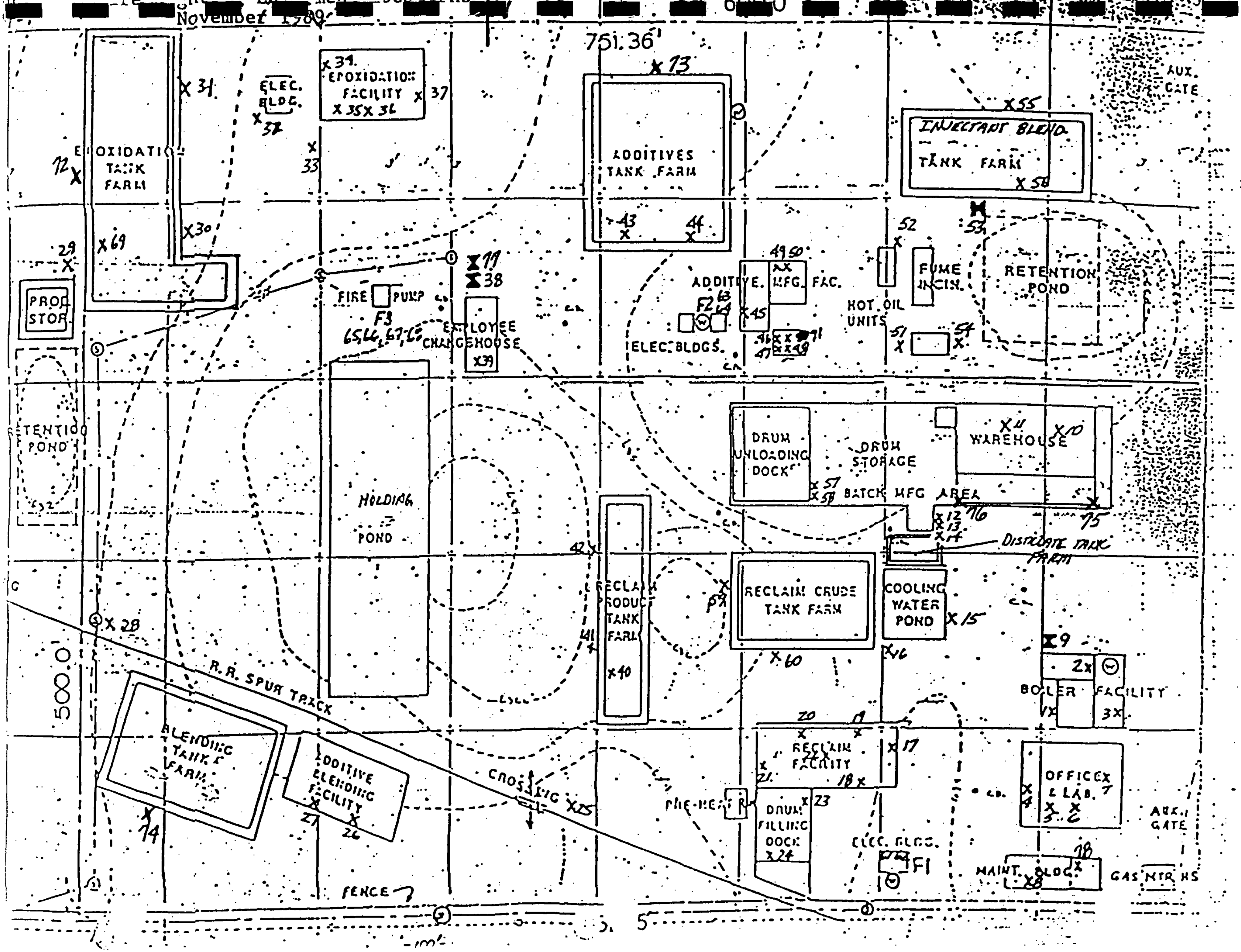
2.) If the fire cannot be controlled, the person should immediately call the Emergency Coordinator or call the beeper numbers. The Emergency Coordinator is responsible for notifying the fire department (924-3151). The person should then contact any other persons in the plant and inform them of the impending danger so response procedures can begin.

3.) Plant personnel after securing their areas, will assist the Emergency Coordinator with the following:

   a.) *Fire fighting operations and associated responses.*

   b.) Turning off electrical equipment in the fire location.

   c.) Taking a head count of employees to determine that all are accounted for.


751.36'
EPOXIDATION TANK FARM
ELEC. BLDG.
EPOXIDATION FACILITY
ADDITIVES TANK FARM
INJECTANT BLEND TANK FARM
AUX. GATE
PROD STOR
RETENTION POND
FIRE PUMP
EMPLOYEE CHANGEHOUSE
ADDITIVE MFG. FAC.
ELEC. BLDGS.
HOT OIL UNITS
FUME INCIN.
RETENTION POND
HOLDING POND
DRUM UNLOADING DOCK
DRUM STORAGE
WAREHOUSE
BATCH MFG AREA
DISTILLATE TANK FARM
RECLAIM PRODUCT TANK FARM
RECLAIM CRUDE TANK FARM
COOLING WATER POND
BOILER FACILITY
R.R. SPUR TRACK
BLENDING TANK FARM
ADDITIVE BLENDING FACILITY
CROSSING
RECLAIM FACILITY
PRE-HEAT
DRUM FILLING DOCK
ELEC. BLDG.
OFFICE & LAB.
AUX. GATE
MAINT. BLDG.
GAS MTR HS
FENCE
500.0

Reviewed: November 1989

LEGEND-

X - PORTABLE HAND EXTINGUISHERS (DRY CHEMICAL) 20#

⋈ - PORTABLE WHEEL EXTINGUISHER (DRY CHEMICAL) 120#

F - STATIONARY HOSE FOAM UNITS 6%

1 - RECLAIM - RADIUS 200' 1½" LINE

2 - ADDITIVE - RADIUS 300' 1½" LINE

3 - EPOXIDATION - RADIUS 350' 2½" LINE

BLENDING FACILITY TANKS AND TANK FARM

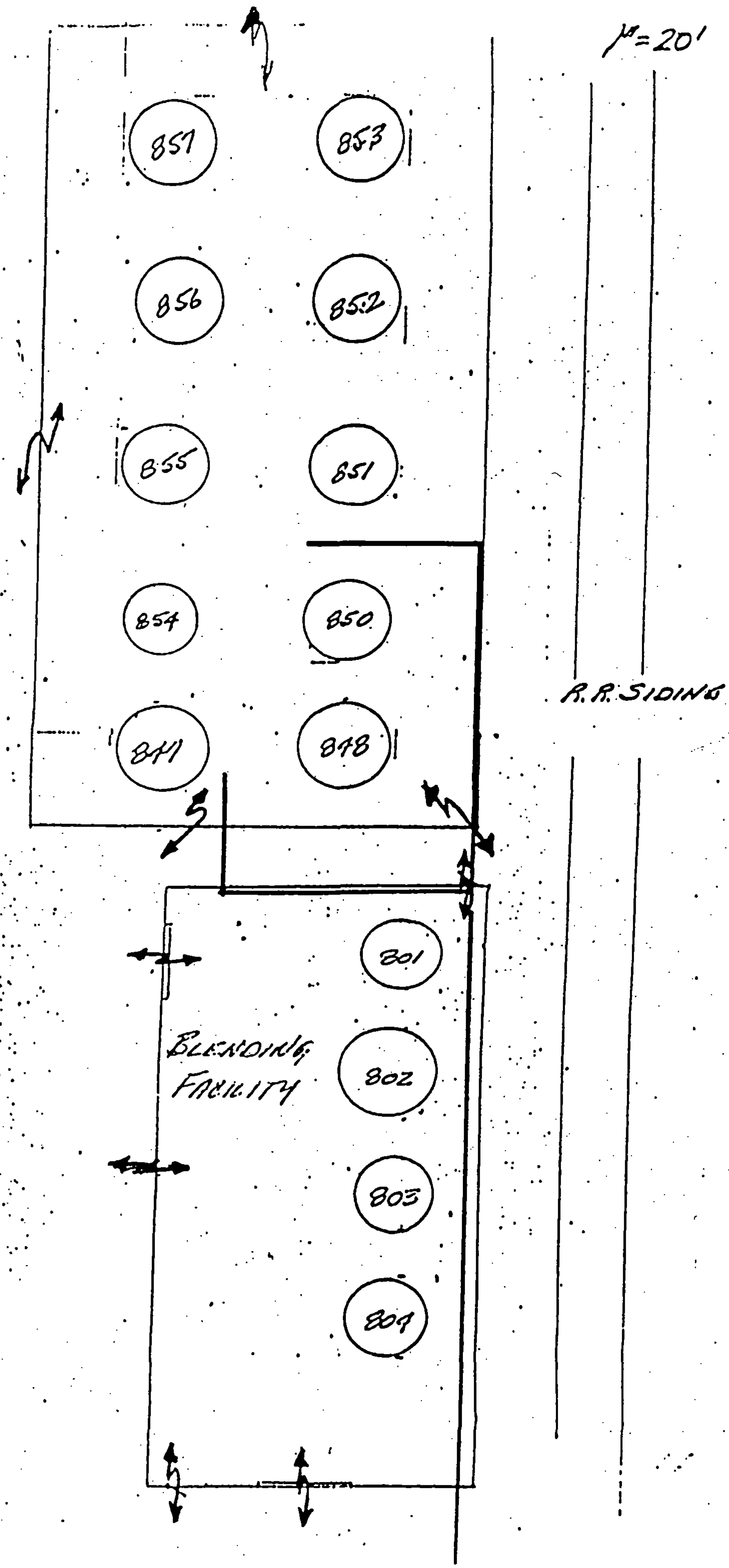
Reviewed: November 1989

TANK NUMBER	VOLUME	MATERIAL	FIRE FIGHTING METHOD
801	8600		
802	18000		
803	8600		
804	12000		
847	35000	COMBUSTABLE LIQUIDS FLASH POINT ABOVE 100^{o}F.	-WITH ALL LISTED TANKAGE USE FOAM ON OPEN FIRES AND WATER TO COOL ADJACENT TANKS.
848	35000		
850	18000		
851	18000		
852	20000		
853	15000		
854	11000		
855	18000		
856	20000		
857	15000		

BLENDING
TANK FARM

NORTH

Reviewed: November 1989



RECLAMATION CRUDE AND PRODUCT TANKS

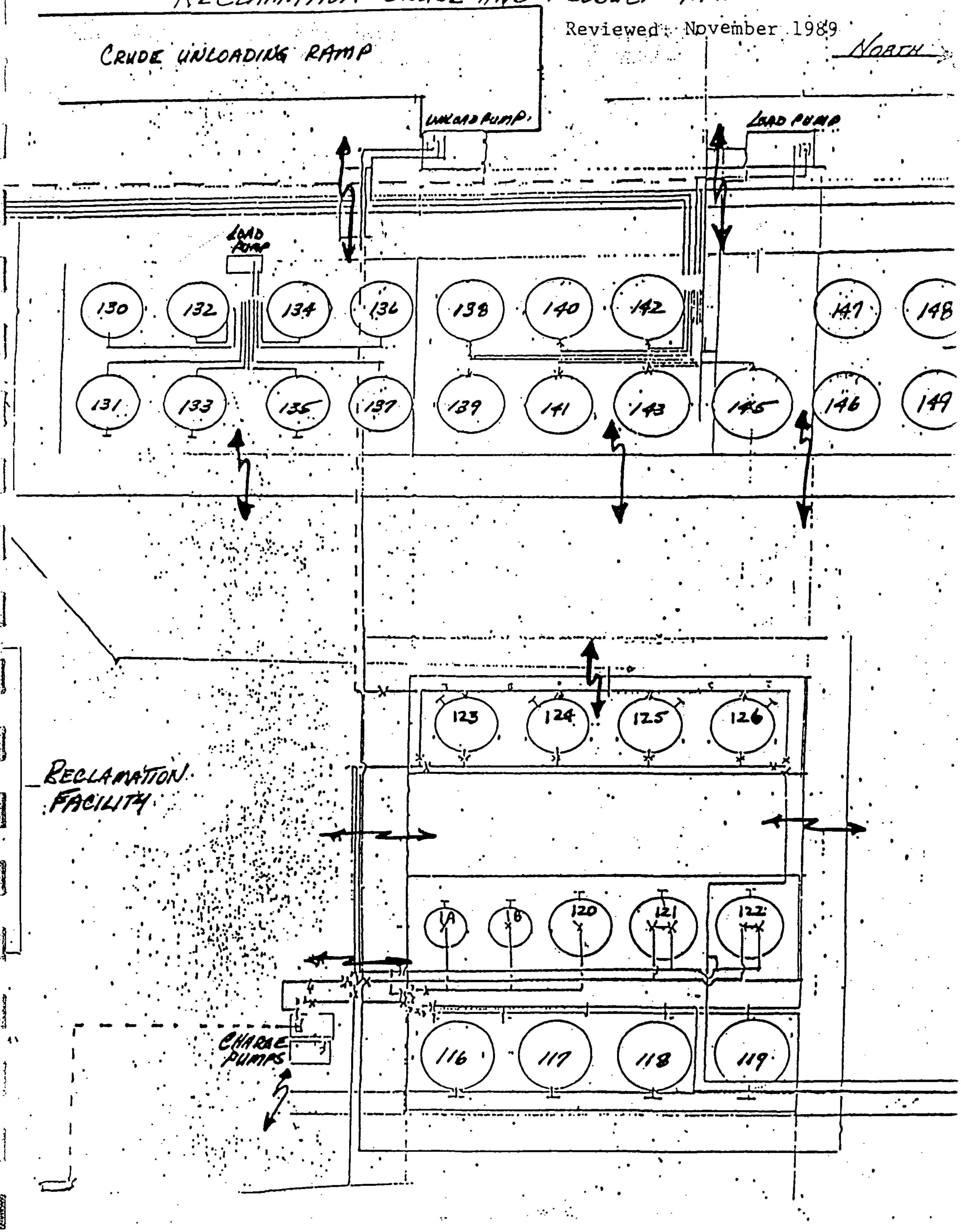
Reviewed: November 1989

TANK NUMBER	VOLUME	MATERIAL	FIRE FIGHTING METHOD
	3000		
1B	3000		
116	12000		
117	12000		
118	12000		
119	12000		
120	6500		
121	11000		
122	11000		
123	20000		
124	20000		
125	20000		
126	20000		WITH ALL LISTED TANKAGE -USE EXTREME CAUTION! -USE FOAM ON OPEN FIRES AND WATER TO COOL ADJACEN[illegible] TANKS.
		FLAMMABLE SOLVENTS	
130	6500	FLASH POINT	
131	6500	BELOW 100°F.	
132	12000		
133	12000		
134	11000		
135	11000		
136	11000		
137	11000		
138	10000		
[illegible]9	10000		
[illegible]0	10000		
141	10000		
142	7000		
143	6500		
145	15000		
146	6000		
147	15000		
148	15000		
149	11000		

CAUTION: 1A & 1B CONTAIN CHLORINATED SOLVENTS WHICH WHEN SUBJECTED TO FIRE COULD PRODUCE ACIDIC GASES.

RECLAMATION CRUDE AND PRODUCT TANKS

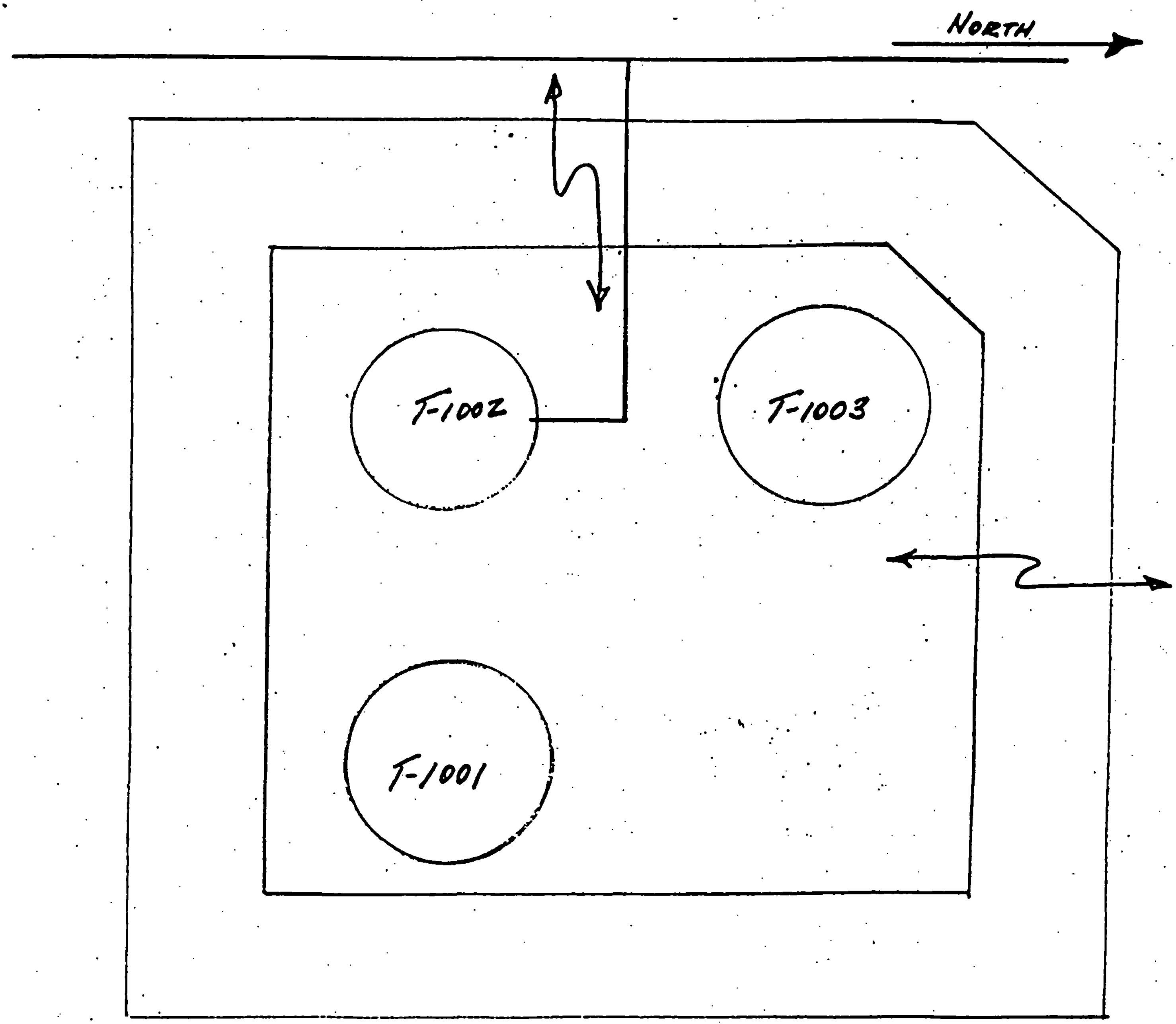
Reviewed: November 1989



DISTILLATE TANK FARM

Reviewed: November 1989

TANK NUMBER	VOLUME	MATERIAL	FIRE FIGHTING METHOD
T-1001	9860	COMBUSTABLE LIQUID FLASH ABOVE 100°F.	WITH ALL TANKAGE LISTED
T-1002	11000	FLAMMABLE SOLVENT FLASH BELOW 100°F.	-USE FOAM ON OPEN FIRES AND WATER TO COOL ADJACENT TANKS.
T-1003	7000	COMBUSTABLE LIQUID FLASH ABOVE 100°F.	-USE CAUTION WITH TANK T-1002

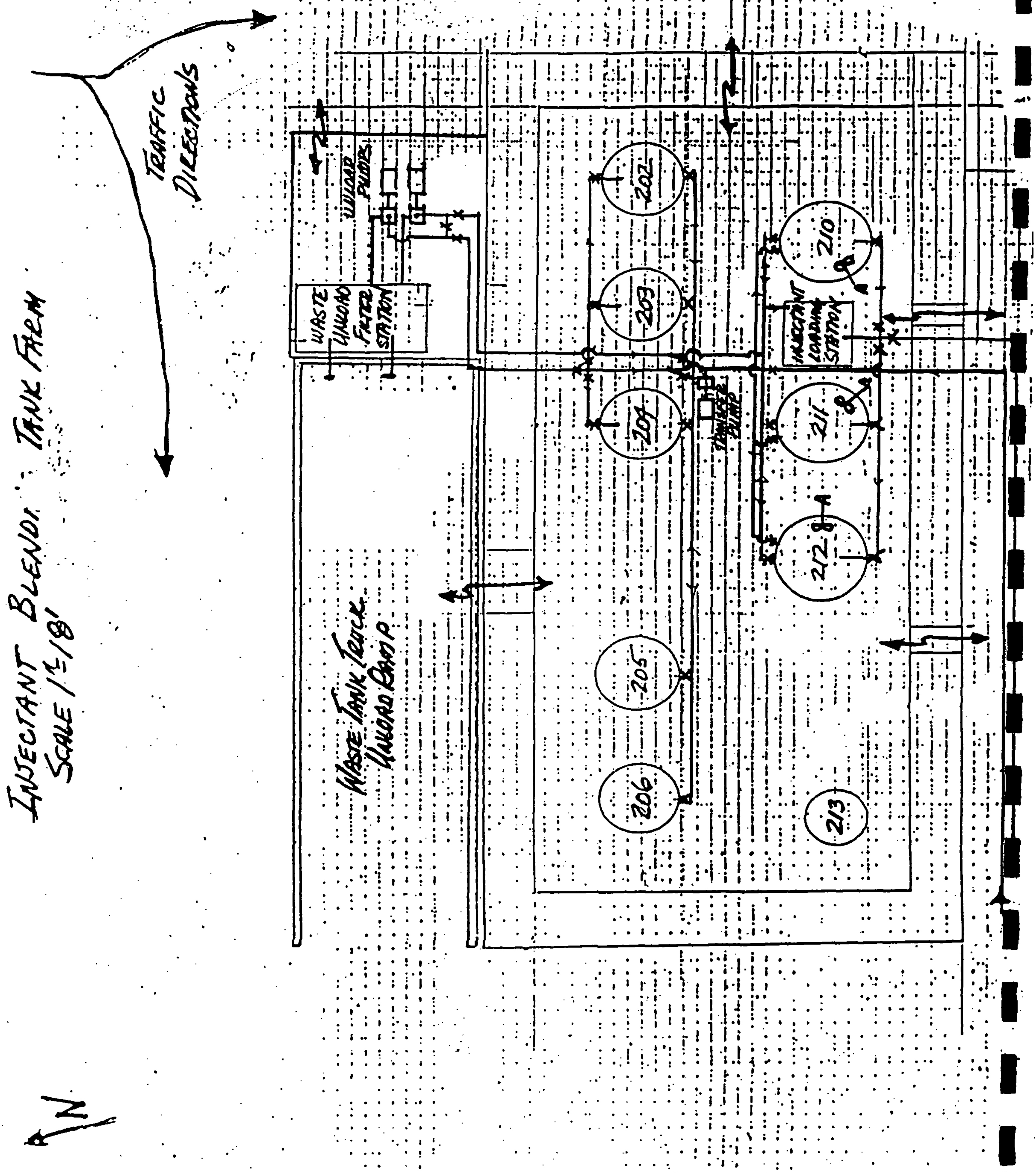


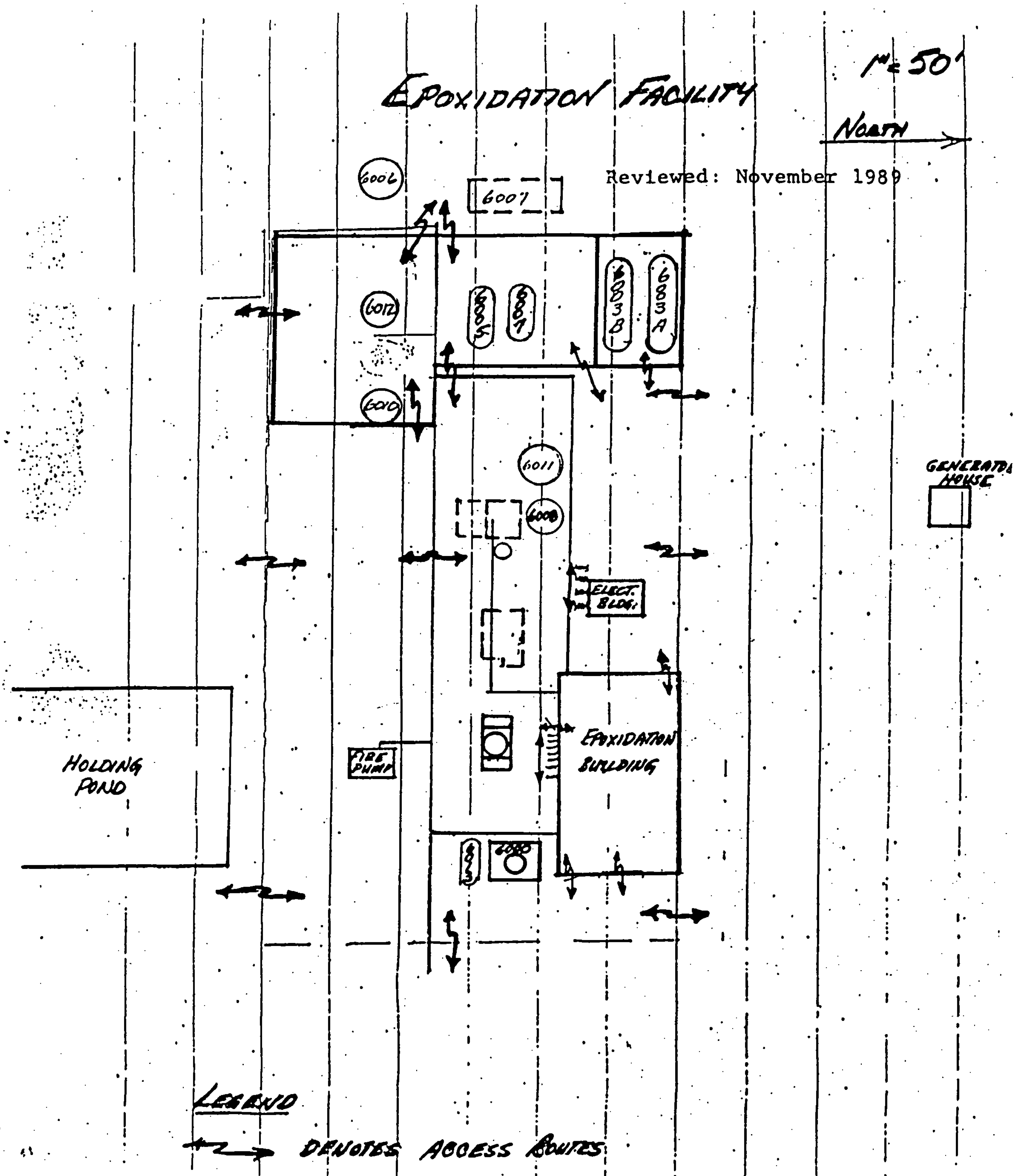
INJECTANT BLENDING TANK FARM

Reviewed: November 1989

TANK NUMBER	VOLUME	MATERIAL	FIRE FIGHTING METHOD
210	25000	↑	
211	25000		
212	25000	FLAMMABLE	WITH ALL LISTED TANKAGE
203	18000	SOLVENTS	-USE EXTREME CAUTION!
204	18000	FLASH POINT	-USE FOAM ON OPEN FIRES
205	18000	BELOW 100° F.	AND WATER TO COOL
202	18000	↓	ADJACENT TANKS.
206	18000		
213	1000	#2 FUEL OIL	

Reviewed: November 1989





EPOXIDATION FACILITY
1" = 50'
NORTH
Reviewed: November 1989
6006
6007
6012
6010
685
687
683B
683A
6011
6008
ELECT. BLDG.
FIRE PUMP
EPOXIDATION BUILDING
603
6020
HOLDING POND
GENERATOR HOUSE
LEGEND
DENOTES ACCESS ROUTES

ADDITIVES FACILITY

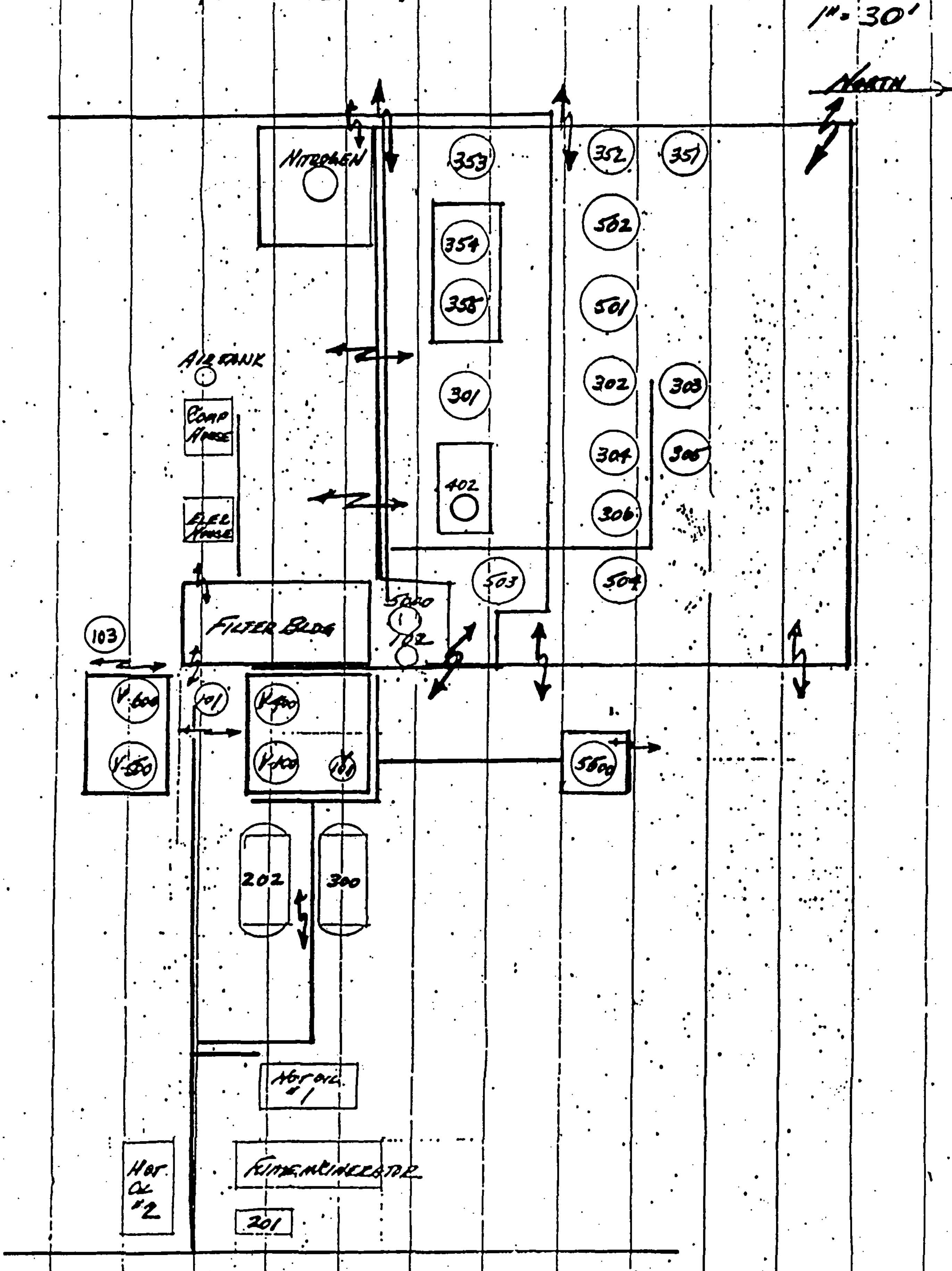
Reviewed: November 1989

TANK NUMBER	VOLUME	MATERIAL	FIRE FIGHTING METHOD
V100	6000		
V101	1100		
101	4000		
102	2000		
103	4000		
201	1600		
202	12000		
300	12000		
301	35000		WITH ALL TANKAGE LISTI
302	35000		COMBUSTABLE LIQUIDS
303	18000	COMBUSTABLE	
304	18000	LIQUIDS	
305	18000	FLASH POINT	-USE FOAM ON OPEN FIRE
306	18000	ABOVE 100° F.	AND WATER TO COOL
351	15000		ADJACENT TANKS
352	15000		
353	18000		
354	24000		
355	24000		
V-400	6000		
402	5300		
V-500	6000		
501	35000		
502	35000		
503	35000		
504	35000		
V-600	8000		
5500	12000		
5000	5600	-FORMALDEHYDE	-COMBUSTABLE LIQUID. CAUTION FROM VAPORS

CAUTION: TANK 303 CONTAINS AN AMINE WHICH WHEN SUBJECTED TO FIRE COULD PRODUCE AMMONIA VAPORS.

ADDITIVES FACILITY

Reviewed: November 1989



american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

HAZARD COMMUNICATIONS PROGRAM TRAINING OUTLINE

The purpose of this program is to provide the employee with information concerning his health, safety and welfare, in the work place. The training outline is structured as follows:

1. How to read and understand MSDS sheets as it pertains to health, flammability, reactivity, and the personal protection to be used for the materials listed in each location. (A typical MSDS sheet will be distributed and each section discussed.)
2. What are TLV's (Threshold limit value), PEL's (Personal exposure limit) and TWA's (Time weight average)?
3. An explanation of how and why HMIS (Hazardous Material Identification System) labels are used for all materials at American Chemical Service Inc. (ACS) in storage tanks, cylinders, reaction vessels, drums, bags, pails, sample jars, etc.

4. The location and interpretation of the posted HMIS information in the facility and what an employee must do and understand before handling the materials. A question and answer period on what an HMIS data sheet and labels are telling the employee.
5. An explanation, that due to the smallness of the plant, certain employees will be required to work in more than one facility. Each employee will be given the required training for every facility he is assigned to work.
6. A review of what materials in the facility present a hazard as to flammability, reactivity, toxic on contact, toxic by inhalation and ingestion, chemical burns, etc.
7. How ACS is taking steps to prevent the over exposure from materials with the use of ventilation equipment, (exhaust fans and roof ventilators), the monitoring of the air in the buildings, personal protective equipment, (glasses, gloves, clothing, hard hats, etc.), medical surveillance, and mechanized process equipment to avoid personal contact.
8. Instruct the employee what personal protective measures will be taken in the facility. Familiarize the employee with the protective equipment for normal and emergency use in his area. Instructions on the use of the equipment and how to obtain replacement equipment.

9. A description of the HMIS labeling plan for all the materials at ACS.

   A. The Hazardous Plan Coordinator will review MSDS sheet on incoming material and determine how to code the HMIS label. Tag each bag, box, drum, etc. before the material is moved from receiving area, or as soon as practicable.

   B. It is the employees responsibility to understand the HMIS sticker. During the training program, each employee is instructed not to move or come in contact with any material in question, but to contact a supervisor or the Hazardous Plan Coordinator for an explanation.

   C. If by chance, an employee discovers an improperly or non-labeled container, he is to notify Hazardous Plan Coordinator and ask for an explanation. The H.P.C. will review MSDS sheets with employees on questionable materials.

   D. Disciplinary action will be taken against violators of the HMIS rules, (Written warning, time off or termination). The contract agreement between the union employees and ACS states that warnings will be submitted in writing to employees for Company rules infractions and a copy will be submitted to the president of the Union. The employees record will be cleared of such warnings every six (6) months for minor violations, and every year for major violations.

E. HMIS data sheets are posted in all the facilities with the instructions of how to read an HMIS sticker.

10 . Briefly review the Emergency Evacuation Plan and the Fire Action Plan for the facility. Copies of the plans are available to all employees on the break house bulletin board and the production office. (A copy of plans are attached)

11. Briefly review the Hazardous Atmosphere Entry Plan for the employees required to enter hazardous atmospheres. A copy of the plan is available to all employees in the production office. (A copy of the plan is attached)

12. A question and answer period will be conducted before the employee signs a form indicating his awareness of the subjects covered in HCP training program.

YEAR:

EMPLOYEE:

JOB DESCRIPTION:

DATE	DESCRIPTION OF TRAINING	PROGRAM TIME	TOTAL TIME TO DATE

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October 16,1989

Revised:
March 5, 1990

TOPIC: ACS LOCKOUT/TAGOUT PROCEDURES

INSTRUCTION:

Each year, thousands of workers are injured on the job due to the accidental release of energy. These injuries could have been avoided if proper LOCKOUT AND TAGOUT procedures had been followed.

LOCKOUT is a padlock placed on a power source with a lockout device that physically holds an energy control point, such as a switch, lever, or valve handle in the "off" position and makes it impossible to operate.

TAGOUT is a written warning that tells co-workers not to operate a switch, lever, or valve that could release hazardous energy or set a machine in motion. Though the tag acts as a warning device, it does not physically prevent someone from releasing the energy.

NOTE - Whether a lock, warning tag or both are used, they must have attached an identification tag which is signed by the employee who applied them. The identification tag is a 2" hinged ring with a write-on aluminum tag.

LOCKOUT AND TAGOUT procedures are designed and implemented to protect you from the accidental release of energy. Its success is dependent upon your understanding and using the procedures outlined in this program.

OBJECTIVE:

The objective of this program is to provide ACS employees with the basic LOCKOUT & TAGOUT principles necessary to eliminate injuries caused by the accidental release of energy. The supervisor reflected on the Lockout/Tagout Checklist will be responsible for executing lockout and tagout procedures.

The equipment ACS may be different from those shown in the videotape, but the techniques and procedures demonstrated remain the same.

LOCKOUT & TAGOUT procedures are designed to ensure ACS employee safety from the release of energy when working in or around machines and systems. Their success and effectiveness depend on you and your coworkers following them. The procedures outlined in this program become effective immediately and are the responsibility of every employee.

Lockouts will be used whenever you are working around any machine or system where unexpected or unintended motion, start-up or release of stored energy could occur and cause injury.

If any ACS equipment cannot be locked out then only with the permission of the supervisor, the equipment will only be secured with warning tags and the identification tag. All new or modified equipment will have lockout capabilities installed.

Any time you place your head, hands, or any other part of your body in a position where they are at risk of being injured by moving equipment, it should be your policy to first perform lockout and tagout procedures.

Common examples of when lockout and tagout procedures should be used include:

** Clearing blocked or jammed mechanisms

** Maintenance or repair work on equipment with moving parts

** Certain confined space entries

** Repairs or installation on electrical circuits

LOCKOUT & TAGOUT PROCEDURES:

It is important that all steps as outlined on the Lockout/Tagout Checklist are followed and no short cuts are taken to ensure proper shut down and LOCKOUT & TAGOUT of equipment.
These steps include:

A SHUT DOWN OF THE OPERATING PROCESS AND IDENTIFICATION OF THE ENERGY TYPES AND SOURCES.

Turn off the switches or press the "off" buttons on the equipment itself, the machine should stop operating. Identify the different sources of energy that power the equipment. Remember, many machines use a combination of energy sources.

ISOLATE ALL ENERGY SOURCES BY FOLLOWING THE STEPS OUTLINED BY THE LOCKOUT/TAGOUT CHECKLIST.

Once you have identified the different sources of energy, isolate them using electrical disconnects, slip binds, valve cables, blocks, pins, etc. Use a padlock to lock the isolating device in place so the energy can not be restored while work is being performed on the equipment. Attach your tag (2" hinged ring with write-on aluminum tag) at all points that you have locked out and sign the tag.

If more than one person is working on a piece of equipment, only one tag is needed. Each worker, however, must attach his own lock. If this is the case, multiple lock hasps are used.

> A FINAL CHECK OF ALL START BUTTONS, VALVES AND LEVERS THAT RELEASE STORED ENERGY AND TO MAKE SURE YOU'VE LOCKED OUT THE PROPER MACHINE.

Remember that isolating the energy source does not guarantee that there is no energy left in the machine. Also, circuits and pipes might be mislabeled, rewired or rerouted.

Some machines will store energy. This residual energy must be released or dissipated from the system to reach a "zero energy state." Make a visual inspection to see that all moving parts have stopped.
Check all buttons or levers to make sure the right sources have been isolated and cycle the equipment if necessary. Carefully drain or bleed any lines. Install ground wires to discharge electricity stored in capacitors.

Return all buttons, levers, and controls to the "off" or "neutral" position. This will prevent the equipment from starting by itself when the lockouts are removed. See Figure 1 for typical Lockout/Tagout Procedures for Electrical and Hydraulic/Pneumatic Sources.

RESPONSIBILITIES WHILE THE EQUIPMENT IS LOCKED OUT:

Try to foresee all possible hazards while performing the work, since installing new piping or wire could bypass the lockout and reactivate the system.

If the job isn't finished in one shift, the person leaving the jobsite doesn't remove his lock and identification tag until the arriving worker has locked out. Place your own lock and identification tag for your own protection.

LOCK & TAG REMOVAL:

Only the worker who places a lock may remove it, except in an emergency. Before removing the last lock, inform all crew members that the locks are going to be removed.

The last person to remove a lock and identification also removes the lockout device and hasp. Tags should be removed and turned in immediately after the work is done. If workers see tags still hanging on equipment that is back in operation, they may begin to ignore other warning tags.

EQUIPMENT START UP AND OPERATION:

Before you turn on the power to any piece of equipment, make a final inspection to be certain it is safe to operate. Check the equipment and surrounding work area to be sure there are not obstructions or incomplete work.

Make sure all tools and other items have been removed. Check to see that all components are fully assembled, machine guards have been installed, and the equipment is ready to operate.

Finally, conduct a personnel count to be sure everyone is physically clear of the equipment. If the machine is too large to see all around during start up, station personnel to observe the area and sound the all clear.

Equipment Utilized for Lockout/Tagout Procedure:

1. Tags:
    A. "DO NOT OPEN THIS VALVE"
    B. "DO NOT CLOSE THIS VALVE"
    C. "DO NOT START THIS MOTOR"
    D. "DO NOT THROW THIS SWITCH"

2. Switch Tong
3. Cable 3/16" x 36" long
4. Locks
5. Identification Tag - 2" hinged ring with write-on aluminum tag.

Periodic Inspection Requirements:

The procedures outlined in this program will be reviewed by the Site Safety and Health Officer during operations. If the program reflects inadequencies, modifications in procedures and/or equipment will be made as soon as possible. The date, location, employees involved and equipment will be logged by the Site Safety and Health Officer.

Initial Training and Periodic Retraining:

All ACS employees will be trained in the ACS Lockout/Tagout Procedures Program. Because of the physical size and number of workers at the facility all ACS employees will be trained to recognize hazardous energy sources and to know the type and magnitude of energy available in the workplace. They will be instructed to know how to isolate and control the energy. All employees, even those not directly involved with the actions requiring the Lockout/Tagout Procedure will be trained to understand the purpose, the use of the energy control procedures and the importance of not trying to circumvent or tamper with them. A copy of the training outline is enclosed as part of this program. Annually all ACS employees will be retrained unless an ACS employee(s) is observed conducting operations not consistent with the Lockout/Tagout Procedures program. In this case the Site Safety and Health Officer will be responsible for the immediate retraining of the employee(s).

Lockout/Tagout Procedures for ACS contractors and subcontractors:

All ACS contractors and subcontractors working at the facility will be required to conform to the procedures outlined in the ACS Lockout/Tagout Procedures Program. The responsibility for this requirement will be with the ACS Site Safety and Health Officer.

Figure 1

Lockout/Tagout Procedure for Electrical Energy Source

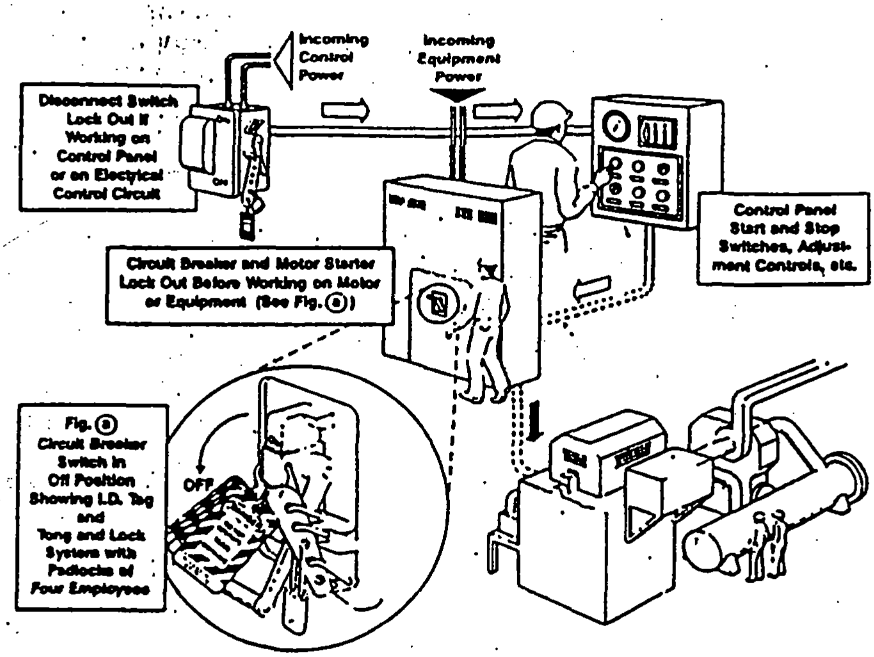
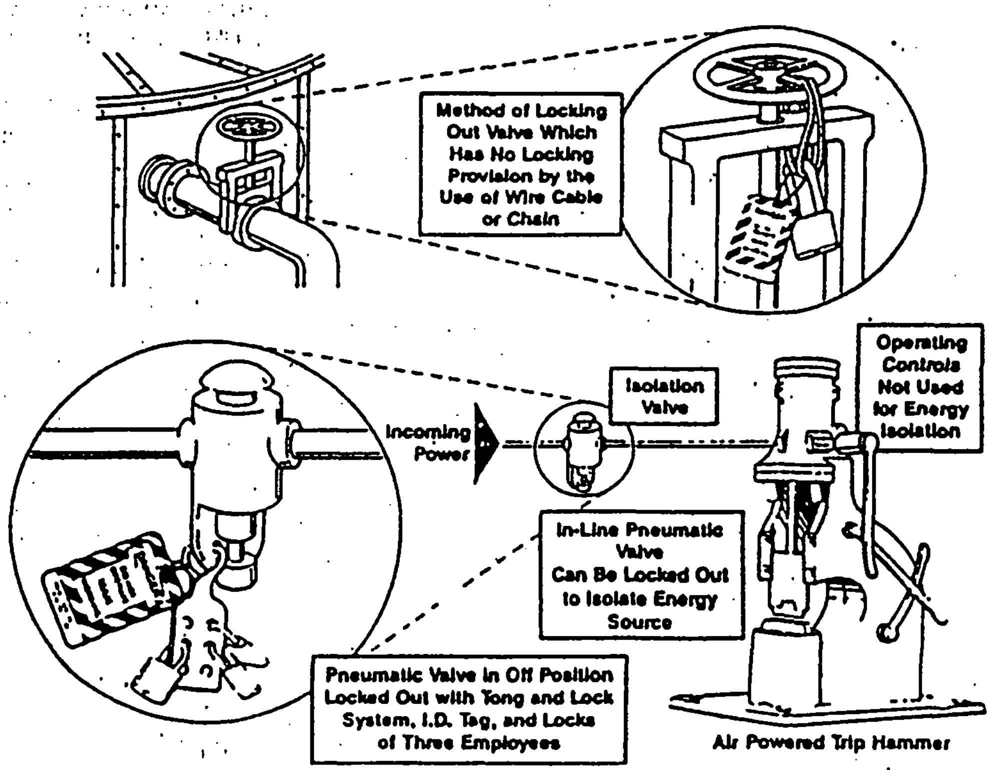


Figure 2

Lockout/Tagout Procedure for Hydraulic/Pneumatic Energy Source



Figures reproduced from American National Standard Z244.1 - 1982

GLOSSARY

BLANK FLANGE - A solid plate or cap (also called a "line blind" or "pancake") installed in a pipe, line, or duct, to ensure its absolute closure and to prevent passage of any material.

DISSIPATE - To release residual energy from a machine or system so that all energy is reduced to a level tolerable to humans (see "Zero Energy State").

ENERGY - The force that is present in machine or system because of movement (see "Kinetic Energy") or the possibility of movement (see "Potential Energy").

ENERGY SOURCE - Any power supply for industrial systems, to include electrical, mechanical, chemical, hydraulic (pressurized liquid), energy, as well as gravity and radiation.

ENGINEERING LOCKOUT - Any mechanical or electrical safety interlock device designed and built into a machine or system to provide automatic protection against human error.

HAZARDOUS ENERGY - Any type of energy that could cause injury or death because it exceeds the level of human tolerance.

LOCKOUT - A padlock placed on a point of control, such as a switch lever or valve handle, to lock the control in the "off" position and prevent the unexpected release of hazardous energy.

LOCKOUT DEVICE - Any easily-recognized mechanical arrangement that prevents the release of hazardous energy by blocking or covering a point of control that can't be directly locked.

MULTIPLE LOCK HASP- A lock adaptor (also called a "clip") that is placed directly on a point of control or on a lockout device, to allow positive lockout by more than one worker.

POINT OF CONTROL - Any electrical or mechanical device, such as a switch or valve, that regulates or stops the flow of energy between a machine or system and its energy source(s).

POTENTIAL ENERGY - The force that is "stored" within an object even when it isn't moving, such as a spring under tension.

RESIDUAL ENERGY - Latent ("leftover") energy that remains in a machine or system after it has been shut down, such as a turning blade or shaft, electricity in a capacitor, or trapped pressure that could unexpectedly release hazardous material or operate a moving part during the work.

TAGOUT - A written warning placed on a point of control that warns other workers not to activate a switch or valve that could release hazardous energy or set a machine in motion.

TWO PERSON RULE - A safety rule stating that two people must be present during the removal of any lock that was placed by someone else, and that no lock may be cut until all workers are known to be clear of the machine or system which is locked out.

ZERO ENERGY STATE (ZES) - The state of a machine or system in which residual energy in any form has been dissipated to a safe level, and lockouts have been installed and verified.

SECTION D:

PERSONAL PROTECTIVE EQUIPMENT

D.) Personal Protective Equipment.

This section addresses the requirement to develop a program of personal protective equipment (PPE) to insure that the level of protection afforded by the PPE is sufficient and continues to be sufficient for employee safety during hazardous waste operations.

Listed below are the PPE in use at ACS:

A.) Safety Caps
B.) Safety Glasses
C.) Safety Spectacles
D.) Face Shields
E.) Dust and Mist Respirators
F.) Organic Vapor Respirators
G.) Self Contained Breathing Apparatus
H.) Supplied Air Breathing Apparatus
I.) Porous Tyvek Coveralls
J.) Tyvek Coveralls
K.) Poly Coated Tyvek Coveralls
L.) Aprons
M.) Vinyl Coated Gauntlet Gloves
N.) Nitrile Gauntlet Gloves
O.) Hot Mill Cloth Gloves
P.) Rubber Overshoes-Steel Toe
Q.) Rubber Overshoes-Slipover
R.) PAL III Personal Alert
S.) Full Face Respirator with Chlorine Cartridges
T.) Saranex Coveralls

At this time the following PPE is required for the following tasks:

As described in Section B:

1.) Operator - A,B,M,O,R, or S.
For emergency situations the following additional PPE is available in the area- D,E,F,J,L,N,Q.

2.) Unloader - A,B,M,O,R.
For emergency situations the following additional PPE is available in the area- D,E,F,J,N,Q.

3.) Loader - A,B,M,O,R.
For emergency situations the following additional PPE is available in the area- D,E,F,J,N,Q.

4.) Tractor Driver - A,B,M,O,R.
For emergency situations the following additional PPE is available in the area- D,E,F,J,L,N,Q.

5.) Laborer - A,B,M,O,R.
Note - for solids, removal from storage tanks and stills - G,H,K & P equipment are used. For emergency situations the following additional PPE is available in the area- D,E,F,J,L,N,Q.

6.) Emergency Response Personnel - A-T
Equipment requirements as designated by the emergency coordinator (Refer to the Contingency Plan Section J)

7.) Solids Pail Loaders - A,,B,F,I & M.
For emergency situations the following additional PPE is available in the area-
D,E,K,N & Q

The following equipment will be assigned to each protection level determined during the Task Risk Analysis Section B.

Level A - A,B,G,H,K,M or N,P or Q,R or T
Level B - A,B,G,H,J,M,Q,R or T
Level C - A,B,F,J,M,Q,R or S or T
Level D - A,B or C or D,O,R
(under dusty conditions add E & I)

The PPE specified for the above protection levels which are assigned to individual tasks may be modified by the results of the Air Monitoring Program Section F. Additional PPE may also be mandated based on regulations, future programs and product development. As these additions are made, this section will be updated.

WILLSON® SAFETY PRODUCTS

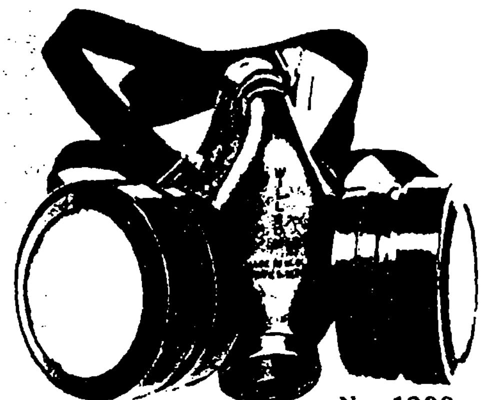
RESPIRATORY PROTECTION

WILLSON 1200 SERIES RESPIRATORS

The "standard of industry" respirator offered with regular and small size half-masks are designed with easy positive pressure fit test. Unique exhalation valve assembly and facial seal design helps prevent contaminants from entering the facepiece. Four-point and single strap adjustable headbands are replaceable. Uses the Willson universal cartridge system for excellent protection in a wide variety of toxic atmospheres. NIOSH/MSHA approved.

Ordering Information:

1200	Regular size basic assembly with elastic headbands
1200S	Small size basic assembly with elastic headbands
1200R	Regular size basic assembly with rubber headbands
1200SR	Small size basic assembly with rubber headbands
1200SS	Regular size basic assembly with elastic single strap headband
1200SSS	Small size basic assembly with elastic single strap headband



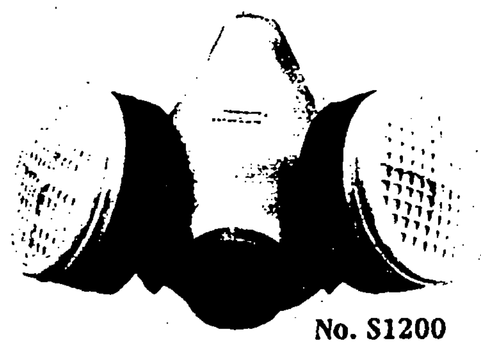
No. 1200

WILLSON SILICONE FACEPIECE

Designed with the same outstanding features as the Willson 1200 Series Respirators but with a silicone half mask for those who prefer that material. Regular and small sizes available.

Ordering Information:

S1200	Regular size silicone facepiece with elastic headbands
S1200S	Small size silicone facepiece with elastic headbands
S1200R	Regular size silicone facepiece with rubber headbands
S1200SS	Regular size silicone facepiece with single strap headband
S1200SSS	Small size silicone facepiece with single strap headband



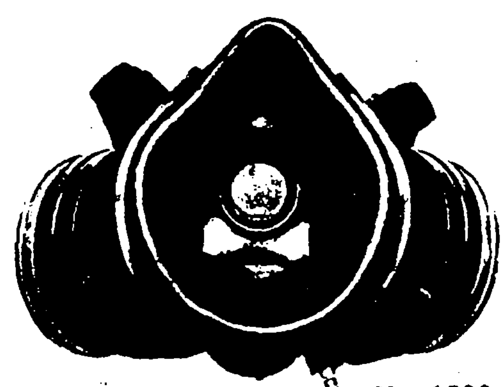
No. S1200

WILLSON 1500 SERIES RESPIRATOR

Just inflate, don and release enough air for proper fit. New inflatable inner seal gives a firm, yet extremely comfortable fit for a variety of facial configurations. Three choices of headbands for added stability and comfort. Easy positive pressure fit testing. Works with the Willson universal cartridge system. NIOSH/MSHA approval pending.

Ordering Information

1500	Basic facepiece with elastic headband
1500R	Basic facepiece with rubber headband
1500SS	Basic facepiece with single strap headband



No. 1500

SEE SEPARATE PAGE FOR COMPLETE WILLSON CARTRIDGE/FILTER/RETAINER SELECTION INFORMATION.

WILLSON SAFETY PRODUCTS

RESPIRATORY PROTECTION

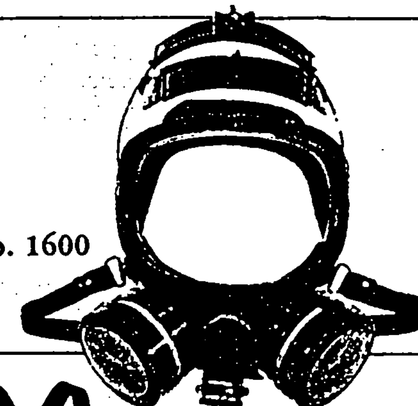
WILLSON 1600 SERIES RESPIRATOR

Full facepiece respirator with ratchet Tite-Seal® headgear is easy to don and adjust. Resistant to scratches and most chemicals, the Astroscopic® lens allows for unobstructed wide angle vision. Deep chin cup and double flange face seal provide superior comfort and fit. Available with a separate mount assembly to secure prescription lenses inside facepiece without affecting the facial seal. Uses the Willson universal cartridge system. NIOSH/MSHA approved.

Ordering Information:

1600	Full facepiece basic assembly with Tite-Seal® headgear

No. 1600

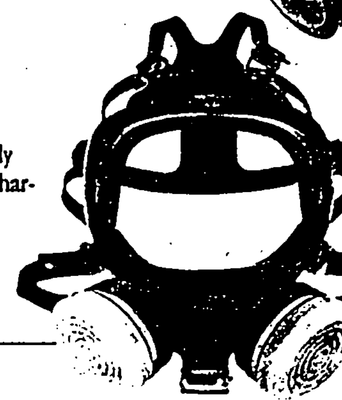


WILLSON 1700 SERIES RESPIRATOR

Versatile full facepiece respirator with six-strap rubber head harness to permit wearing safety caps. Spectacle mount assembly for prescription eyewear users also available. Same chin cup, flange face seal and wide angle lens design as the Willson 1600 respirator. Features the Willson universal cartridge system. NIOSH/MSHA approved.

Ordering Information:

1700	Full facepiece basic assembly with six-strap rubber head harness



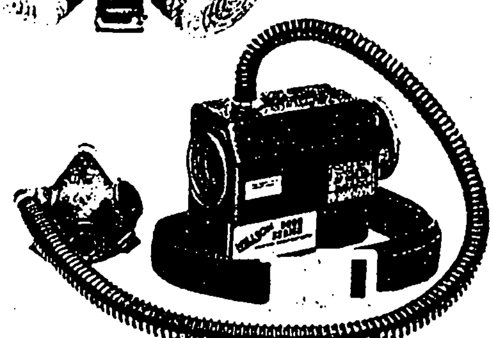
No. 1700

WILLSON 3000 SERIES BREATHING ASSIST RESPIRATOR

Battery-powered assist respirator provides a supply of filtered, comfortable air to the user with little breathing resistance. Controllable airflow permits worker to adjust flow up to 1.5 CFM. Available in half mask or full facepiece styles; interchanges with the Willson line of dual cartridge filters and cartridges. Recommended for respiratory protection in potentially explosive atmospheres. NIOSH/MSHA approved. MSHA approved as intrinsically safe.

Ordering Information:

3000	Breathing assist respirator with regular size half mask
3000S	Breathing assist respirator with small size half mask
3100	Breathing assist respirator with Tite-Seal® full facepiece
3200	Breathing assist respirator with six-strap full facepiece



No. 3000

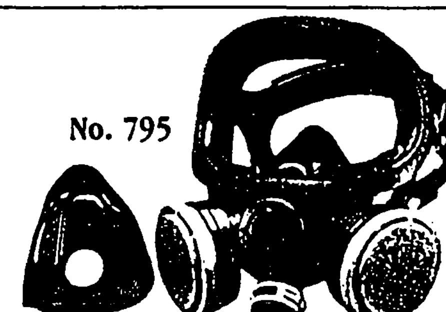
WILLSON ORAL/NASAL MASK

A full facepiece respirator accessory that helps reduce internal fogging and carbon dioxide (CO_2) buildup. Oral/Nasal Mask captures a worker's exhaled air and channels it directly through the respirator's exhalation valve. Designed for easy retrofit.

Ordering Information:

R-795	Oral/Nasal Mask
R-793	Long Exhalation Valve Cover for Retrofit
R-794	Long Exhalation Valve Seat for Retrofit.

No. 795



SEE SEPARATE PAGE FOR COMPLETE WILLSON CARTRIDGE/FILTER/RETAINER SELECTION INFORMATION.

WILLSON® 1200 SERIES RESPIRATORS INSTRUCTION SHEET

The Willson 1200 Series Respirator provides a wide range of protection against many industrial respiratory hazards. The basic facepiece assemblies can be fitted with a variety of cartridges and filters combining versatile, economical respiratory protection with wearing comfort. The basic facepiece can be quickly modified for a variety of uses, by simply changing the cartridge-filter combination. Facepieces are molded of resilient rubber or silicone with soft comfortable rolled edges and easily adjustable headbands.

Respirator Number	Hazard Description	NIOSH/MSHA Approved No.	USE Cartridge	USE Filter
S1210/S1210S/1210/1210S	Dust/Mist	TC-21C-140	—	R10
S1211/S1211S/1211/1211S	Dust/Mist/Fumes	TC-21C-141	—	R11
S1212/S1212S/1212/1212S	Radionuclide	TC-21C-142	—	R12
S1217/S1217S/1217/1217S	Dust/Mist/Fumes	TC-21C-365	—	R17
S1221/S1221S/1221/1221S	Organic Vapor	TC-23C-50	R21	—
S122110/S122110S/ 122110/122110S	Organic Vapor, Dust/Mist	TC-23C-51	R21	R10
S122113/S122113S/ 122113/122113S	Organic Vapor, Dust/ Fumes/Mist	TC-23C-52	R21	R13
S122[illegible]/S122115S/ 1221[illegible]22115S	Organic Vapor, Pesticides, Paint, Lacquer, and Enamel Mists, and Dusts and Mists	TC-23C-54	R21	R15
S122116/S122116S/ 122116/122116S	Organic Vapor, Paint, Lacquer, and Enamel Mists	TC-23C-258	R21	R16
S122117/S122117S/ 122117/122117S	Organic Vapor, Paint, Lacquer and Enamel Mists, Pesticides Dusts/Fumes/Mists	TC-23C-729	R21	R17
S1224/S1224S/1224/1224S	Ammonia/Methylamine	TC-23C-70	R24	—
122410/S122410S/ 122410/122410S	Ammonia/Methylamine, Dust/Mist	TC-23C-71	R24	R10
S122417/S122417S/ 122417/122417S	Ammonia/Methylamine Dust, Fumes and Mists	TC-23C-723	R24	R17
S1225/S1225S/1225/1225S	Organic Vapor/Acid Gas	TC-23C-76	R25	—
S122510/S122510S/ 122510/122510S	Organic Vapor/Acid Gas/ Dust/Mist	TC-23C-77	R25	R10
S122517/S122517S/ 122517/122517S	Organic Vapor/Acid Gas/ Dust/Fumes/Mist	TC-23C-717	R25	R17
S1231/S1231S/1231/1231S	Organic Vapor	TC-23C-293	R31	—
S123112/S123112S/ 123112/123112S	Organic Vapor/Radionuclide	TC-23C-294	R31	R12
S1234/S1234S/1234/1234S	Ammonia/Methylamine	TC-23C-289	R34	—
S123412/S123412S/ 123412/123412S	Ammonia/Methylamine/ Radionuclide	TC-23C-291	R34	R12
S1235/S1235S/1235/1235S	Organic Vapor/Acid Gas	TC-23C-298	R35	—
S123512/S123512S/ 123512/123512S	Organic Vapor/Acid Gas/ Radionuclide	TC-23C-299	R35	R12
S1226/S1226S/1226/1226S	Acid Gases/Formaldehyde	TC-23C-699	R26	—
S122610/S122610S/ 122610/122610S	Acid Gases/Formaldehyde/ Dust/Mist	TC-23C-705	R26	R10
S122617/S122617S/ 122617/122617S	Acid Gases/Formaldehyde/ Dust/Fumes/Mist	TC-23C-710	R26	R17

Before using the respirator, carefully read the following instructions and refer to the NIOSH/MSHA approval label sheet whenever necessary.

LIMITATIONS AND WARNINGS

1. The instructions furnished with these respirators are for your benefit, to inform you of the specific limitations, proper use and required maintenance of your Willson respirator. For your effective protection, read and understand them before using the respirator.
2. Respirators labeled for protection against particulates only shall not be used for gases or vapors. Respirators labeled for protection against gases and vapors only shall not be used for particulates. Always read cartridge and/or filter labels prior to use to ascertain that you are using the correct respirator for your application.
3. **THIS RESPIRATOR DOES NOT SUPPLY OXYGEN. DO NOT USE IN ATMOSPHERES CONTAINING LESS THAN 19.5% OXYGEN BY VOLUME.**
4. **DO NOT USE WHEN CONCENTRATIONS OF CONTAMINANTS ARE UNKNOWN OR IMMEDIATELY DANGEROUS TO LIFE OR HEALTH. DO NOT USE IN POORLY VENTILATED AREAS, OR CONFINED SPACES SUCH AS TANKS OR SMALL ROOMS UNLESS ADEQUATE VENTILATION IS PROVIDED.**
5. Leave the area immediately if:
   a. breathing becomes difficult.
   b. You smell or taste the contaminant or if your senses indicate any abnormal conditions.
   c. dizziness or other distress occurs.
   d. the respirator is damaged.
6. Never alter or modify the respirator. Altering or modifying the respirator will void all approvals and may contribute to a reduction in protection to the user.
7. This respirator is for use only by trained qualified personnel in accordance with a respirator program outlined in ANSI Standard Z88.2-1980 and OSHA Regulation 1910.134. Copies of the ANSI Standard may be obtained by writing ANSI, 1430 Broadway, New York 10018.

1210/1210S/S1210/S1210S

PERMISSIBLE

RESPIRATOR FOR DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-140

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-140

Issued to Willson Safety Products, May 8, 1985 for dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R10 (TC-21C-140) filters and R682 filter retainers.

1211/1211S/S1211/S1211S

PERMISSIBLE

RESPIRATOR FOR DUSTS, FUMES, AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-141

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average not less than 0.05 milligram per cubic meter, dusts and mists having a time-weighted average not less than 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-141

Issued to Willson Safety Products, May 8, 1985 for dusts, fumes, and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, and R11 (TC-21C-141) filters.

1212/1212S/S1212/S1212S

PERMISSIBLE

RESPIRATOR FOR DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-142

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average less than 0.05 milligrams per cubic meter, asbestos containing dusts and mists, and radionuclides.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-142

Issued to Willson Safety Products, September 13, 1984 for dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece and R12 (TC-21C-142) filters.

122116/122116S/S122116/S122116S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PAINT, LACQUER AND ENAMEL MISTS, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-258

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) mists of paints, lacquers and enamels; (2) not more than 1,000 parts per million organic vapors by volume; (3) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot; and (4) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-258

Issued to Willson Safety Products, February 2, 1984 for organic vapors, paint, lacquer and enamel mists, and dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R21 (TC-23C-50) cartridges, R18 (TC-23C-258) filters, and R683 filter retainers.

1200 w/R24

1224/1224S/S1224/S1224S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA AND METHYLAMINE

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-70

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 300 parts per million ammonia, or 100 parts per million methylamine.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-70

Issued to Willson Safety Products, February 2, 1984 for ammonia and methylamine.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece and R24 (TC-23C-70) cartridges.

122410/122410S/S122410/S122410S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA, METHYLAMINE, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-71

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 300 parts per million ammonia; (2) not more than 100 parts per million methylamine; (3) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-71

Issued to Willson Safety Products, May 8, 1985 for ammonia, methylamine, and dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R24 (TC-23C-70) cartridges, R10 (TC-21C-140) filters and R682 retainers.

1200 w/ R21

1221/1221S/S1221/S1221S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-50
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-50

Issued to Willson Safety Products, February 2, 1984 for organic vapors.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece and R21 (TC-23C-50) chemical cartridges.

122110/122110S/S12210/S122110S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-51
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume, dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-51

Issued to Willson Safety Products, May 8, 1985 for organic vapors and dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R21 (TC-23C-50) cartridges, R10 (TC-21C-140) filters, and R682 filter retainers.

122113/122113S/S122113/S122113S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, AND DUSTS, FUMES, AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-52
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors by volume; (2) dusts, fumes and mists have a time-weighted average not less than 0.05 milligram per cubic meter; (3) dusts and mists having a time-weighted average not less than 2 million particles per cubic foot; and (4) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-52

Issued to Willson Safety Products, May 8, 1985 for dusts, fumes, mists, and organic vapors.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R21 (TC-23C-50) cartridges, and R13 (TC-23C-52) filters.

1200 w/ R25

1225/1225S/S1225/S1225S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, AND SULFUR DIOXIDE

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-76
ISSULD TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-76

Issued to Willson Safety Products, February 2, 1984 for organic vapors, chlorine, hydrogen chloride, and sulfur dioxide.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece and R25 (TC-23C-76) cartridges.

122510/122510S/S122510/S122510S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-77
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-77

Issued to Willson Safety Products, May 8, 1985 for organic vapors, chlorine, hydrogen chloride, and sulfur dioxide, and dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R25 cartridges (TC-23C-77), R10 (TC-21C-140) filters, and R682 filter retainers.

123112/123112S/S123112/S123112S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-294
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume and dusts, fumes and mists having a time-weighted average of less than 0.05 milligrams per cubic meter, asbestos containing dusts and mists, and radionuclides.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-294

Issued to Willson Safety Products, September 13, 1984 for organic vapors, dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R31 (TC-23C-293) cartridges, and R12 (TC-21C-142) filters.

122115/122115S/S122115/S122115S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PESTICIDES, PAINT, LACQUER, AND ENAMEL MISTS, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-54

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against (1) not more than 1,000 parts per million organic vapors by volume, (2) pesticides, (3) mists of paints, lacquers and enamels, (4) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot, and (5) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not approved for fumigants.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

Refer to pesticide label for limitations on respirator use.

MSHA-NIOSH APPROVAL TC-23C-54

Issued to Willson Safety Products, February 2, 1984 for organic vapors, pesticides, paint, lacquer, and enamel mists and dusts and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R21 (TC-23C-54) cartridges, R15 (TC-23C-54) filters, and [illegible] filter retainers.

123412/123412S/S123412/S123412S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA, METHYLAMINE, DUSTS, FUMES, MISTS AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-291

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 300 parts per million ammonia; (2) not more than 100 part per million methylamine; (3) dusts, fumes and mists having a time-weighted average of less than 0.05 milligrams per cubic meter, asbestos containing dusts and mists, and radionuclides.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-291

Issued to Willson Safety Products, September 13, 1984 for ammonia, methylamine, dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R34 (TC-23C-289) cartridges, and R12 (TC-21C-142) filters.

1217/1217S/S1217/S1217S

PERMISSIBLE
RESPIRATOR
FOR
DUSTS, FUMES, AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-21C-365
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average not less than 0.05 milligram per cubic meter, dusts and mists having a time-weighted average not less than 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-365

Issued to Willson Safety Products, May 19, 1986, for dusts, fumes, and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R17 (TC-21C-366) filters, R662 filter retainers and R663 filter holder inserts.

122117/122117S/S1212117/S122217S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PESTICIDES, PAINT, LACQUER, AND ENAMEL MISTS, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-23C-729
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors by volume; (2) pesticides; (3) mists of paints, lacquers and enamels; (4) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot, and (5) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not approved for fumigants.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-729

Issued to Willson Safety Products, May 19, 1986, for organic vapors, pesticides, paint, lacquer, and enamel mists and dusts, fumes and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700S facepiece, R21 (TC-23C-60) cartridges, R17 (TC-21C-366) filters, and R662 filter retainers.

122417/122417S/S122417/S122417S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR
FOR
AMMONIA, METHYLAMINE, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-23C-723
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 300 parts per million ammonia; (2) not more than 100 parts per million methylamine; (3) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-723

Issued to Willson Safety Products, May 19, 1986, for ammonia, methylamine, and dusts, fumes and mists.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R34 (TC-23C-70) cartridges, R17 (TC-21C-366) filters, and R662 retainers.

122610/122610S/S122610/S122610S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-23C-705
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 30 parts per million formaldehyde; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; or (4) not more than 50 parts per million sulfur dioxide; (5) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-705

Issued to Willson Safety Products, May 19, 1986, for formaldehyde, chlorine, hydrogen chloride, sulfur dioxide, and dusts and mists.

The approved assembly consists of the following Willson parts. AR700 or AR700S or SAR700 or SAR700S facepiece, R36 cartridges (TC-23C-690), R10 (TC-21C-140) filters, and R662 filter retainers.

122617/122617S/S122617/S122617S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-23C-711
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 30 parts per million formaldehyde; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-711

Issued to Willson Safety Products, May 19, 1986, for formaldehyde, chlorine, hydrogen chloride, and sulfur dioxide, and dusts, fumes and mists.

The approved assembly consists of the following Willson parts. AR700 or AR700S or SAR700 or SAR700S facepiece, R26 cartridges (TC-23C-689), R17 (TC-21C-366) filters, and R662 filter retainers.

122517/122517S/S122517/S122517S

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
APPROVAL NO. TC-23C-717
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-717

Issued to Willson Safety Products, May 19, 1986, for organic vapors, chlorine, hydrogen chloride, sulfur dioxide, and dusts, fumes and mists.

The approved assembly consists of the following Willson parts. AR700 or AR700S or SAR700 or SAR700S facepiece, R25 cartridges (TC-23C-76), R17 (TC-21C-366) filters, and R662 filter retainers.

123512/123512S/S123512/S123512S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-299

ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts, fumes and mists having a time-weighted average of less than 0.05 milligram per cubic meter, asbestos containing dusts and mists, and radionuclides.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-299

Issued to Willson Safety Products, September 13, 1984 for organic vapors, chlorine, hydrogen chloride, sulfur dioxide, and dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR700 or AR700S or SAR700 or SAR700S facepiece, R36 (TC-23C-298) cartridges and R12 filters (TC-21C-142).

1200 w/ R26

1226/1226S/S1226/S1226S

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, AND SULFUR DIOXIDE

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-699

ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 20 parts per million formaldehyde, (2) not more than 10 parts per million chlorine, (3) not more than 50 parts per million hydrogen chloride, or (4) not more than 50 parts per million sulfur dioxide.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-699

Issued to Willson Safety Products, May 19, 1986, for formaldehyde, chlorine, hydrogen chloride, and sulfur dioxide.

The approved assembly consists of the following Willson parts AR700 or AR700S or SAR700 or SAR700S facepiece and R26 (TC-23C-699) cartridges.

WILLSON® 1600/1700 SERIES RESPIRATORS INSTRUCTION SHEET

The Willson 1600/1700 Series Respirator provides a wide range of protection against many industrial respiratory hazards. The basic facepiece assemblies can be fitted with a variety of cartridges and filters combining versatile, economical respiratory protection with wearing comfort. The basic facepiece can be quickly modified for a variety of uses, by simply changing the cartridge-filter combination. Facepieces are molded of resilient rubber with soft comfortable rolled edges, an adjustable face sealing flange, and easily adjustable headbands.

Respirator Number	Hazard Description	NIOSH/MSHA Approved No.	USE Cartridge	USE Filter
1610/1710	Dust/Mist	TC-21C-182	—	R10
1611/1711	Dust/Mist/Fumes	TC-21C-183	—	R11
1612/1712	Radionuclide	TC-21C-184	—	R12
1617/1717	Dust/Mist/Fumes	TC-21C-367	—	R17
1621/1721	Organic Vapor	TC-23C-130	R21	—
162110/172110	Organic Vapor, Dust/Mist	TC-23C-134	R21	R10
162113/172113	Organic Vapor, Dust/Fumes/Mist	TC-23C-131	R21	R13
162115/172115	Organic Vapor, Pesticides, Paint, Lacquer, and Enamel Mists, and Dusts and Mists	TC-23C-133	R21	R15
162116/172116	Organic Vapor, Paint, Lacquer, and Enamel Mists, and Dusts and Mists	TC-23C-259	R21	R16
162117/172117	Organic Vapor, Paint, Lacquer and Enamel Mists, Pesticides, Dusts/Fumes/Mists	TC-23C-730	R21	R17
1624/1724	Ammonia/Methylamine	TC-23C-139	R24	—
162410/172410	Ammonia/Methylamine, Dust/Mist	TC-23C-140	R24	R10
162417/172417	Ammonia/Methylamine, Dust/Fumes/Mists	TC-23C-724	R24	R17
1625/1725	Organic Vapor/Acid Gas	TC-23C-141	R25	—
162510/172510	Organic Vapor/Acid Gas/ Dust/Mist	TC-23C-142	R25	R10
162517/172517	Organic Vapor/Acid Gas/ Dust/Fume/Mist	TC-23C-718	R25	R17
1626/1726	Formaldehyde/Acid Gas	TC-23C-700	R26	—
162610/172610	Formaldehyde/Acid Gas/ Dust/Mist	TC-23C-707	R26	R10
162617/172617	Formaldehyde/Acid Gas/ Dust/Mist/Fumes	TC-23C-712	R26	R17
1631/1731	Organic Vapor	TC-23C-295	R31	—
163112/173112	Organic Vapor/Radionuclide	TC-23C-296	R31	R12
1634/1734	Ammonia/Methylamine	TC-23C-290	R34	—
163412/173412	Ammonia/Methylamine, Radionuclide	TC-23C-292	R34	R12
1635/1735	Organic Vapor/Acid Gas	TC-23C-300	R35	—
163512/173512	Organic Vapor/Acid Gas, Radionuclide	TC-23C-301	R35	R12

Before using the respirator, carefully read the following instructions and refer to the NIOSH/MSHA approval label sheet whenever necessary.

LIMITATIONS AND WARNINGS

1. The instructions furnished with these respirators are for your benefit, to inform you of the specific limitations, proper use and required maintenance of your Willson respirator. For your effective protection, read and understand them before using the respirator.
2. Respirators labeled for protection against particulates only shall not be used for gases or vapors. Respirators labeled for protection against gases and vapors only shall not be used for particulates. Always read cartridge and/or filter labels prior to use to ascertain that you are using the correct respirator for your application.
3. **THIS RESPIRATOR DOES NOT SUPPLY OXYGEN. DO NOT USE IN ATMOSPHERES CONTAINING LESS THAN 19.5% OXYGEN BY VOLUME.**
4. **DO NOT USE WHEN CONCENTRATIONS OF CONTAMINANTS ARE UNKNOWN OR IMMEDIATELY DANGEROUS TO LIFE OR HEALTH. DO NOT USE IN POORLY VENTILATED AREAS, OR CONFINED SPACES SUCH AS TANKS OR SMALL ROOMS UNLESS ADEQUATE VENTILATION IS PROVIDED.**
5. Leave the area immediately if:
   a. breathing becomes difficult.
   b. You smell or taste the contaminant or if your senses indicate any abnormal conditions.
   c. dizziness or other distress occurs.
   d. the respirator is damaged.
6. Never alter or modify the respirator. Altering or modifying the respirator will void all approvals and may contribute to a reduction in protection to the user.
7. This respirator is for use only by trained qualified personnel in accordance with a respirator program outlined in ANSI Standard Z88.2-1980 and OSHA Regulation 1910.134. Copies of the ANSI Standard may be obtained by writing ANSI, 1430 Broadway, New York 10018.

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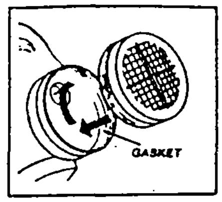
8. The assembled respirator may not provide a satisfactory facial seal with certain physical characteristics such as a beard or gross sideburns which may result in leakage around the facepiece seal, which voids or limits the protection. If such a condition exists, the user assumes all risks of bodily injury which may possibly result.
9. Failure to follow all instructions and warnings on the use of this product and/or failure to wear this respirator during all times of exposure will reduce respirator effectiveness and wearer protection, which may result in serious injury or death.
10. Facial or barrier creams must not be used when wearing respirators. They do not aid in obtaining a leak proof seal and may cause deterioration of the facepiece material.
11. Following is a Partial List of gaseous material for which chemical cartridge respirators should not be used for respiratory protection regardless of concentration or time of exposure. This Partial List is offered only as a guide to proper evaluation of the many contaminants found in industry.
    1. Acrolein
    2. Aniline
    3. Arsine
    4. Boron Hydrides
    5. Bromide
    6. Carbon Dioxide
    7. Carbon Monoxide
    8. Carbonyls
    9. Cyanogen
    10. Dimethylaniline
    11. Dimethylsulfate
    12. Hydrogen Cyanide
    13. Hydrogen Selenide
    14. Hydrogen Sulfide
    15. Mercury Vapor
    16. Isocyanates
        MDI
        TDI
        HDI
    17. Methyl Bromide
    18. Methyl Chloride
    19. Methyl Iodine
    20. Nitro compounds:
        Nitrogen Oxides
        Nitroglycerine
        Nitromethane
        Nitrobenzene
    21. Ozone
    22. Perchloroethane
    23. Phosgene
    24. Phosphine
    25. Phosphorous Trichloride
    26. Stibine
    27. Sulfur Chloride
    28. Vinyl Chloride

    Negative pressure air purifying respirators are not to be used for compounds which have poor or inadequate warning properties at or below the Threshold Limit Value (TLV). The use of any negative pressure air purifying, respirators **will not completely eliminate** all of the hazard encountered by the wearer. Caution must be taken when entering an atmosphere where carcinogens are suspected below the TLV.
12. Never alter or modify this device. Alterations and modifications void the NIOSH approval and can result in reduction of respirator effectiveness.

INSTRUCTIONS FOR USE



1. Remove respirator, cartridges, and/or filters from package. Be sure gaskets are properly positioned in the cartridge holders before screwing in cartridges. Insert filter into retainer caps and snap onto cartridge holder or cartridges. Insure that filters are correctly centered in the cartridge holder and sealing all around the periphery. When using R17 filters without cartridges screw R883 insert into cartridge holder to the point where it seals against the gasket. Insert filter into retainer caps and snap onto holder.

2. The cartridge holders are keyed to assure their correct positioning and maintain the proper balance of the device. Make sure they are properly positioned and seated.

3. **PUTTING ON RESPIRATORS**

1600 STYLE—TITE-SEAL HEADGEAR

(a) LOOSEN BOTH RATCHET ADJUSTMENTS ON THE TITE-SEAL® molded plastic headgear.

(b) PLACE MASK ON FACE with Tite-Seal headgear raised over the head, FITTING MASK AGAINST CHIN FIRST. Grasp Outlet Valve at front with one hand to hold repsirator facepiece against the face. With the other hand, move molded headgear down over the head. Tighten each ratchet adjustment for comfortable fit. *Once the Tite-Seal headgear has been fitted, it* can be removed by simply flipping the headgear forward with no further adjustment of the ratchets.

1700 STYLE—SIX—STRAP HEADGEAR

(a) PULL ALL SIX HEAD STRAPS OUT TO THE END TABS.

(b) Clasp temple and neck straps with each respective hand, as close to facepiece as possible, and STRETCH STRAPS OVER HEAD, FITTING MASK AGAINST THE CHIN FIRST.

(c) PULL NECK STRAPS FIRST as tightly as necessary to obtain a snug fit. (At this stage mask may still hand lower than desired).

(d) PULL TEMPLE STRAPS next, tight enough to insure a snug fit.

(e) PULL TOP FOREHEAD STRAPS last, completing air-tight seal. To avoid forehead kinks, pull these two straps toward each other.

INSTRUCTIONS FOR POSITIVE AND NEGATIVE PRESSURE FIT CHECK

Fit checks should be performed **each** *time the respirator is donned.*

POSITIVE PRESSURE FIT CHECK

(PREFERRED METHOD)
Place palm of hand or thumb over the hole in the exhalation valve cover and exhale gently to cause a slight positive pressure inside the facepiece. If the facepiece bulges slightly and no air leaks between the face and facepiece are detected, a proper fit has been obtained. If air leakage is detected, reposition the respirator on the face and/or readjust the tension of the headbands to eliminate the leakage.

NEGATIVE PRESSURE FIT CHECK

Place palms of hands or surgical gloves over the cartridges and/or filters, inhale gently and hold breath for five to ten seconds. If the facepiece collapses slightly a proper fit has been obtained. If air leakage is detected, reposition the respirator on the face and/or adjust tension of the headbands to eliminate the leakage.

CAUTION: IF YOU CANNOT ACHIEVE A PROPER FIT DO NOT ENTER CONTAMINATED AREAS. SEE YOUR SUPERVISOR.

92J

1610/1710 RESPIRATOR

PERMISSIBLE

RESPIRATOR FOR DUSTS AND MISTS

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-182

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-182

Issued to Willson Safety Products, May 8, 1985 for dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R10 (TC-21C-140) filters, and R682 filter retainers.

1611/1711 RESPIRATOR

PERMISSIBLE

RESPIRATOR FOR DUSTS, FUMES, AND MISTS

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-183

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average not less than 0.05 milligram per cubic meter, and dusts and mists having a time-weighted average not less than 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-183

Issued to Willson Safety Products, May 8, 1985 for dusts, fumes, and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece and R11 (TC-21C-141) filters.

1612/1712 RESPIRATOR

PERMISSIBLE

RESPIRATOR FOR DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-184

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average less than 0.05 milligram per cubic meter, asbestos containing dusts and mists, and radionuclides.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-184

Issued to Willson Safety Products, September 13, 1984 for dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece and R12 (TC-21C-142) filters.

162110/172110 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS AND DUSTS AND MISTS

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-134

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume, dusts and *mists having a time-weighted average not less than 0.05 milli*gram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent materials in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-134

Issued to Willson Safety Products, May 8, 1985 for dusts, mists, and organic vapors.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R21 (TC-23C-50) cartridges, *R10 (TC-21C-140) filters, and R682 filter retainers.*

163112/173112 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-296

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume, dusts, fumes and mists having a time-weighted average of less than 0.05 milligram per cubic meter, asbestos containing dusts and mists, and radionuclides.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval *shall be maintained.*

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-296

Issued to Willson Safety Products, September 13, 1984 for organic vapors, dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R31 (TC-23C-280) cartridges and R12 filters (TC-21C-142).

162115/172115 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PESTICIDES, PAINT, LACQUER, AND ENAMEL MISTS, AND DUSTS AND MISTS

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-133

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against (1) not more than 1,000 parts per million organic vapors by volume; (2) pesticides; (3) mists of paints, lacquers and enamels; (4) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot, and (5) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not approved for fumigants.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

Refer to pesticide label for limitations on respirator use.

MSHA-NIOSH APPROVAL TC-23C-133

Issued to Willson Safety Products, May 3, 1977 for organic vapors, pesticides, paint, lacquer, and enamel mists, and dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R21 (TC-23C-50) cartridges, R15 (TC-23C-54) filters, and R682 filter retainers.

92K

1700 w/ R21
1600 w/ R21

1700 w/R24
1600 w/R24

1621/1721 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-130

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than 1,000 parts per million organic vapors by volume.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-130

Issued to Willson Safety Products, December 1, 1976 for organic vapors.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece and R21 (TC-23C-50) cartridges.

1624/1724 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA AND METHYLAMINE

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-139

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against not more than, 300 parts per million ammonia, or 100 parts per million methylamine.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-139

Issued to Willson Safety Products, December 8, 1976 for ammonia and methylamine

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece and R24 (TC-23C-70) cartridges.

163412/173412 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA, METHYLAMINE, DUSTS, FUMES, MISTS AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-292

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 300 parts per million ammonia; (2) not more than 100 part per million methylamine; (3) dusts, fumes and mists having a time-weighted average of less than 0.05 milligrams per cubic meter, asbestos containing dusts and mists, and radionuclides.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-292

Issued to Willson Safety Products, September 13, 1984 for ammonia, methylamine, dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R34 (TC-23C-289) cartridges, and R12 (TC-21C-142) filters.

162116/172116 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PAINT, LACQUER AND ENAMEL MISTS, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-259

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) mists of paints, lacquers and enamels; (2) not more than 1,000 parts per million organic vapors by volume; (3) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot; and (4) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-259

Issued to Willson Safety Products, May 3, 1979 for organic vapors, paint, lacquer and enamel mists, and dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R21 (TC-23C-50) cartridges, R18 (TC-23C-258) filters, and R683 filter retainers.

162113/172113 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, AND DUSTS, FUMES, AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-131

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors by volume; (2) dusts, fumes and mists have a time-weighted average not less than 0.05 milligram per cubic meter; (3) dusts and mists having a time-weighted average not less than 2 million particles per cubic foot; and (4) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-131

Issued to Willson Safety Products, May 8, 1985 for dusts, fumes, mists, and organic vapors.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R21 (TC-23C-50) cartridges, and R13 (TC-23C-62) filters.

162410/172410 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA, METHYLAMINE, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-140

ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 300 parts per million ammonia; (2) not more than 100 parts per million methylamine; (3) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-140

Issued to Willson Safety Products, May 8, 1985 for ammonia, methylamine, and dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R24 (TC-23C-70) cartridges, R10 (TC-23C-70) filters, and R682 filter retainers.

/86

162417/172417 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR AMMONIA, METHYLAMINE AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-724
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against (1) not more than 300 parts per million ammonia or 100 parts per million methylamine, (2) dusts, fumes and mists having a time-weighted average not less than 0.05 milligrams per cubic meter or 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-724

Issued to Willson Safety Products, May 1[illegible], 19[illegible], for ammonia, methylamine, dusts, fumes and mists.

The approved assembly consists of the following Willson parts: AH1000 or AH1700 facepiece, H24 (TC-23C-7[illegible]) cartridges, H17 (TC-21C-3[illegible]) filters and R[illegible] filter retainers.

162617/172617 RESPIRATOR

PERMISSIBLE

CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-712
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against (1) not more than 30 parts per million formaldehyde; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts, fumes and mists having a time-weighted average of not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-712

Issued to Willson Safety Products, May 1[illegible], 19[illegible], for formaldehyde, chlorine, hydrogen chloride, sulfur dioxide and dusts, fumes, and mists.

The approved assembly consists of the following Willson parts: AR1800 or AR1700 facepiece, R26 (TC-23C-[illegible]) cartridges and R17 filters (TC-21C-3[illegible]) and H[illegible] filter retainers.

1600 w/R25

1625/1725 RESPIRATOR

PERMISSIBLE
**CHEMICAL CARTRIDGE RESPIRATOR
FOR
ORGANIC VAPORS, CHLORINE,
HYDROGEN CHLORIDE, AND SULFUR DIOXIDE**

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH

APPROVAL NO. TC-23C-141
ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-141

Issued to Willson Safety Products, December 8, 1978 for organic vapors, chlorine, hydrogen chloride, and sulfur dioxide.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R25 (TC-23C-76) cartridges.

162510/172510 RESPIRATOR

PERMISSIBLE
**CHEMICAL CARTRIDGE RESPIRATOR FOR
ORGANIC VAPORS, CHLORINE,
HYDROGEN CHLORIDE, SULFUR DIOXIDE,
AND DUSTS AND MISTS**

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL
SAFETY AND HEALTH

APPROVAL NO. TC-23C-142
ISSUED TO

WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-142

Issued to Willson Safety Products, May 8, 1986 for organic vapors, chlorine, hydrogen chloride, sulfur dioxide, and dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R25 (TC-23C-76) cartridges, R10 (TC-21C-140) filters, and R682 filter retainers.

163512/173512 RESPIRATOR

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, DUSTS, FUMES, MISTS, AND RADIONUCLIDES

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-301
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U. S. A.

LIMITATIONS

Approved for respiratory protection against: (1) not more than 1,000 parts per million organic vapors; (2) not more than 10 parts per million chlorine; (3) not more than 50 parts per million hydrogen chloride; (4) not more than 50 parts per million sulfur dioxide; (5) dusts, fumes and mists having a *time-weighted average of less than 0.05 milligram per cubic* meter, asbestos containing dusts and mists, and radionuclides.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats *of reaction with sorbent material in the cartridge.*

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-301

Issued to Willson Safety Products, September 13, 1984 for organic vapors, chlorine, hydrogen chloride, sulfur dioxide, and dusts, fumes, mists, and radionuclides.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R35 (TC-23C-298) cartridges and R12 filters (TC-21C-142).

1617/1717 RESPIRATOR

PERMISSIBLE
RESPIRATOR FOR DUSTS, FUMES, AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-21C-387
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against dusts, fumes, and mists having a time-weighted average not less than 0.05 milligram per cubic meter, and dusts and mists having a time-weighted average not less than 2 million particles per cubic foot.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-21C-387

Issued to Willson Safety Products, May 19, 1986, for dusts, fumes, and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R17 (TC-21C-385) filters, R882 filter retainers, and R883 filter holder inserts.

1700 w/ 26
1600 w/ R26

162117/172117 RESPIRATOR

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, PESTICIDES, PAINT, LACQUER, AND ENAMEL MISTS, DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-730
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against: (1) mists of paints, lacquers and enamels; (2) not more than 1,000 parts per million organic vapors by volume; (3) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot; (4) pesticides; and (5) any combination thereof.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-730

Issued to Willson Safety Products, May 19, 1986, for organic vapors, pesticides, paint, lacquer and enamel mists, and dusts, fumes and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R21 (TC-23C-80) cartridges, R17 (TC-21C-385) filters, and R882 filter retainers.

162517/172517 RESPIRATOR

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR ORGANIC VAPORS, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS, FUMES AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-718
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U S A

LIMITATIONS

Approved for respiratory protection against (1) not more than 1,000 parts per million organic vapors, (2) not more than 10 parts per million chlorine, (3) not more than 50 parts per million hydrogen chloride, (4) not more than 50 parts per million sulfur dioxide, (5) dusts, fumes and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not wear for protection against organic vapors with poor warning properties or those which generate high heats of reaction with sorbent material in the cartridge.

Maximum use concentrations will be lower than 1,000 parts per million organic vapors where that concentration produces atmospheres immediately dangerous to life or health.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-718

Issued to Willson Safety Products, May 19, 1986, for organic vapors, chlorine, hydrogen chloride, sulfur dioxide, and dusts, fumes and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R25 (TC-23C-78) cartridges, R17 (TC-21C-385) filters and R882 filter retainers.

1626/1726 RESPIRATOR

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, AND SULFUR DIOXIDE

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-700
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against (1) not more than 30 parts per million formaldehyde, (2) not more than 10 parts per million chlorine, (3) not more than 50 parts per million hydrogen chloride, or (4) not more than 50 parts per million sulfur dioxide.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-700

Issued to Willson Safety Products, May 19, 1986, for formaldehyde, chlorine, hydrogen chloride, and sulfur dioxide.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece and R26 (TC-23C-[illegible]) cartridges.

162610/172610 RESPIRATOR

PERMISSIBLE
CHEMICAL CARTRIDGE RESPIRATOR FOR FORMALDEHYDE, CHLORINE, HYDROGEN CHLORIDE, SULFUR DIOXIDE, AND DUSTS AND MISTS

MSHA NIOSH

MINE SAFETY AND HEALTH ADMINISTRATION
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH

APPROVAL NO. TC-23C-707
ISSUED TO
WILLSON SAFETY PRODUCTS
READING, PENNSYLVANIA, U.S.A.

LIMITATIONS

Approved for respiratory protection against (1) not more than [illegible] parts per million formaldehyde, (2) not more than 10 parts per million chlorine, (3) not more than 50 parts per million hydrogen chloride, or (4) not more than 50 parts per million sulfur dioxide, (5) dusts and mists having a time-weighted average not less than 0.05 milligram per cubic meter or 2 million particles per cubic foot.

Do not use in concentrations which generate high heats of reaction.

Not for use in atmospheres containing less than 19.5 percent oxygen.

Not for use in atmospheres immediately dangerous to life or health.

CAUTION

In making renewals or repairs, parts identical with those furnished by the manufacturer under the pertinent approval shall be maintained.

Follow the manufacturer's instructions for changing cartridges and filters.

This respirator shall be selected, fitted, used, and maintained in accordance with Mine Safety and Health Administration, Occupational Safety and Health Administration, and other applicable regulations.

MSHA-NIOSH APPROVAL TC-23C-707

Issued to Willson Safety Products, May 19, 1986, for formaldehyde, chlorine, hydrogen chloride, sulfur dioxide, and dusts and mists.

The approved assembly consists of the following Willson parts: AR1600 or AR1700 facepiece, R26 (TC-23C-[illegible]) cartridges, R10 (TC-21C-140) filters, and R882 filter retainers.

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

JUNE 1990

AMERICAN CHEMICAL SERVICE, INC.
PERSONAL PROTECTIVE EQUIPMENT

RESPIRATOR:	A - WILLSON MODEL 1700 FULL FACE MASK		
	B - WILLSON MODEL 1200 HALF FACE MASK		
	C - 8710 NON TOXIC PARTICLE MASK		
CARTRIDGE:	A - WILLSON R-21	ORGANIC VAPORS	(BLACK)
	B - WILLSON R-25	BROMINE, CHLORIDE & ORGANIC VAPORS	(YELLOW)
	C - WILLSON R-26	FORMALDEHYDE & ACID GASES	(WHITE)
	D - WILLSON R-24	AMMONIA & AMINE	(GREEN)
GLOVES:	A - VINYL COATED GAUNTLET		(YELLOW OR BLACK)
	B - NITRILE RUBBER		(BLACK & LABELED)
	C - SILVER SHIELD		(SILVER)
	D - NEOPRENE		(BLACK & LABELED)
PROTECTIVE COVERALLS:	A - TYVEK 1417		(WHITE)
	B - POLYCOATED TYVEK 5417		(YELLOW)
	C - SARANEX W/BOOTS 77415		(WHITE)
	D - CHEMREL W/BOOTS & HOOD C202		(GRAY)
	E - NEOPRENE JACKET, OVERALL W/FACE SHIELD		(GREEN)
PROTECTIVE BOOTS:	A - TYVEK 414		(WHITE)
	B - POLYCOATED TYVEK 514		(YELLOW)
	C - POLYVINYL SLIPOVER		(BLACK)
	D - NEOPRENE OVERSHOE		(TAN)

SUBSTANCE WARNING EXPLANATION:

<u>SKIN</u> - REFERS TO SUBSTANCES KNOWN FOR HIGH SKIN ABSORPTION
<u>VAPORS</u> - EXPOSURE WARNING WHEN SUBSTANCE IS VAPORIZED
<u>LOW EXPOSURE LIMIT</u> - 10 DOWN TO 1 ppm EXPOSURE FOR AN 8 HOUR WEIGHTED AVERAGE
<u>VERY LOW EXPOSURE LIMIT</u> - 1 OR LESS ppm EXPOSURE FOR AN 8 HOUR WEIGHTED AVERAGE

GROUP: SUBSTANCES COVERED UNDER THRESHOLD LIMIT VALUES

JUNE 1990

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
64-19-7 ACETIC ACID		LOW EXPOSURE LIMIT	B	A	A	B	B OR C
8-24-7 ETIC ANHYDRIDE		LOW EXPOSURE LIMIT	B	A	C	D	-----
67-64-1 ACETONE	CELTONE		B	A	C	D	-----
75-05-8 ACETONITRILE			B	A	C	D	-----
628-63-7 AMYL ACETATE	n-AMYL ACETATE		B	A	A	B	B OR C
71-41-0 AMYL ALCOHOL			B	A	B	A	A OR C
7440-39-3 BARIUM, SOLUBLE COMPOUNDS	17194-00-2 BARIUM OCTAHYDRATE		C	-----	A	A	A OR C
71-43-2 BENZENE		LOW EXPOSURE LIMIT SUSPECTED CARCINOGEN	B	A	C	D	-----
7726-95-6 BROMINE		VERY LOW EXPOSURE LIMIT	A	B	D	E	D

GROUP: SUBSTANCES COVERED UNDER THRESHOLD LIMIT VALUES

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELL
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
BUTYL ACETATE	123-86-4 n-BUTYL ACETATE 105-46-4 Sec-BUTYL ACETATE		B	A	C	B	B OR C
1-36-3 BUTYL ALCOHOL	71-36-3 n-BUTYL ALCOHOL 78-92-2 Sec-BUTYL ALCOHOL	SKIN	B	A	D	A	A OR C
1305-78-8 CALCIUM OXIDE		LOW EXPOSURE LIMITS	C	-----	A	A	A OR C
75-15-0 CARBON DISULFIDE		SKIN LOW EXPOSURE LIMIT	B	A	C	D	------
56-23-5 CARBON TETRACHLORIDE	CARBON TET	SKIN LOW EXPOSURE LIMIT SUSPECTED	B	A	C	D	-----
1305-62-0 CALCIUM HYDROXIDE	LIME	LOW EXPOSURE LIMIT	C	-----	A	A	A

GROUP: SUBSTANCES COVERED UNDER THRESHOLD LIMIT VALUES

RESPIRATOR:
A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE:
A - WILLSON R-21 ORGANIC VAPORS (BLACK
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES:
A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS:
A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GR
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS:
A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
C-9 OR PANALENE	25551-13-7 TRIMETHYL BENZENE 91-20-3 NAPTHALENE T-500	LOW EXPOSURE LIMIT	B	A	B	D	-----
WASH SOLVENT	ACETONE, METHANOL TOLUENE, MEK XYLENE, MIBK BUTYL CELLESOLVE		B	A	C	D	-----
CHEM FUEL K BLEND	SAME AS CT WASH SOLV.		B	A	C	D	-----
108-90-7 CHLORO-BENZENE			B	A	C	D	-----
98-82-8 CUMENE	C-9 A-6976	SKIN	B	A	B	D	-----
110-82-1 CYCLOHEXANE	LACTOL SPIRITS		B	A	C	D	-----
108-91-8 CYCLOHEXLY-AMINE	ENTEC 947	LOW EXPOSURE LIMIT	A	D	C	D	-----
123-42-2 DIACETONE ALCOHOL			B	A	D	D	-----

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORINE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & ACID GASES (WHITE)
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
111-40-0 DIETHYLENE TRIAMINE	DETA	SKIN, VERY LOW EXPOSURE LIMIT	A	D	D	E	D
100-37-8 DIETHYLAMINO-ETHANOL	ENTEC 947 DEAF	SKIN, LOW EXPOSURE LIMIT	B	A	B	B	B OR C
141-78-6 ETHYL ACETATE			B	A	C	D	-----
64-17-5 ETHYL ALCOHOL	ETHANOL ENTEC 327 BUTYL CARBITOL		B	A	D	B	B OR C
100-41-4 ETHYL BENZENE	DuPONT DCI 6A		B	A	C	D	-----
107-15-3 ETHYLENE-DIAMINE	EDA CPS-6 CPS-2	LOW EXPOSURE LIMIT	A	D	D	C	-----
107-06-2 ETHYLENE DICHLORIDE	EDC	VERY LOW EXPOSURE LIMITS	A	A	C	D	-----
107-21-1 ETHYLENE GLYCOL	UNIVERSAL FOAM 3 & 6%(OLD FOAM) METHYL CELLOSOLVE	VAPOR	B	A	A	C	-----

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
60-29-7 ETHYL ETHER			B	A	C	C	-----
50-00-0 FORMALDEHYDE	FB 905 FB 905-21, FB 983	VERY LOW EXPOSURE LIMIT SUSPECTED CARCINOGEN	A	C	B	B	B
64-18-6 FORMIC ACID		LOW EXPOSURE LIMIT	A	C	D	D	-----
98-01-1 FORFURAL	QUACOOR 1220 RESIN	SKIN, LOW EXPOSURE LIMIT	B	A	C	B	B OR C
98-00-0 FURFURAL ALCOHOL	FA, QUACOOR 1001 KOLD CURE 1-M FB 905, FB 905-21 FB 963, QUACOOR 1300 RESIN, QUACOOR 1200 RESIN	SKIN LOW EXPOSURE LIMIT	B	A	C	B	B OR C
8006-61 GASOLINE	GAS		B	A	B	A	A OR C
110-80-5 GLYCOL ETHER	2-ETHOXYETHANOL	SKIN	B	A	A	A	A OR C

GROUP: SUBSTANCES COVERED UNDER THRESHOLD LIMIT VALUES

.ESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
142-82-5 HEPTANE	n-HEPTANE		B	A	B	B	B OR C
110-54-4 HEXANE	n-HEXANE		B	A	C	D	------
17-41-5 HEXYLENE GLYCOL	UNIVERSAL FOAM 3 & 6% (OLD FOAM)	VAPOR	B	A	A	C	-----
74-90-8 HYDROGEN CYANIDE	INGREDIENT OF DIBASIC ESTER	LOW EXPOSURE LEVEL SKIN	A	C	A	B	B or C
7722-84-1 HYDROGEN PEROXIDE	PEROXIDE	VERY LOW EXPOSURE LIMIT	B	A	B	B	B OR C
123-31-9 HYDROQUINONE	108-46-3 RESORCINOL	LOW EXPOSURE LEVEL	B	A	D	B	B OR C
78-83-1 ISOBUTYL ALCOHOL	IBA ISOBUTANOL		B	A	B	A	A OR C
78-59-1 ISOPHORONE		LOW EXPOSURE LIMIT	B	A	D	A	A OR C

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
108-21-4 ISOPROPYL ACETATE			B	A	A	A	A OR C
67-63-0 ISOPROPYL ALCOHOL	IPA ENTEC 327		B	A	A	A	A OR C
LACQUER THINNER	ACETONE, TOLUENE METHANOL, MIBK XYLENE, MEK BUTYL CELLOSOLVE		B	A	C	D	-----
64742-89-8 LACTOL SPIRITS	CYCLOHEXANE HEPTANE METHYLCYCOHEXANE TOLUENE		B	A	C	D	-----
108-31-6 MALEIC ANHYDRIDE	MA	VERY LOW EXPOSURE LIMIT	A	A	D	B	B OR C
79-20-9 METHYL ACETATE			B	A	B	B	B OR C
96-33-3 METHYL ACRYLATE		LOW EXPOSURE LEVELS SKIN	B	A	B	B	B OR C

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
67-56-14 METHANOL	METHYL ALCOHOL CELTONE (ACETONE) SODIUM, METHYLATE SILANE 1160	SKIN	B	A	D	C	-----
71-55-6 METHYL LOROFORM	1,1,1 TRI AND/OR (FREON)		B	A	C	D	-----
108-87-2 METHYLCYCLO-HEXANE	LACTOL SPIRITS		B	A	B	D	-----
75-09-2 METHYLENE CHLORIDE		SUSPECTED CARCINOGEN	B	A	C	D	-----
78-93-3 METHYL ETHYL KETONE	MEK 2-BUTANONE		B	A	D	D	-----
108-10-1 METHYL ISOBUTYL KETONE	MIBK HEXONE		B	A	B	C	-----
91-20-3 NAPHTHALENE	A-8091 NALCO A-8065 5451 MARKER MP SOLV G	LOW EXPOSURE LEVELS	B	A	B	D	-----

GROUP: SUBSTANCES COVERED UNDER THRESHOLD LIMIT VALUES

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
7440-02-0 NICKEL, SOLUBLE COMPOUND	3333-67-3 NICKEL CARBONATE 373-02-4 NICKEL ACETATE	LOW EXPOSURE LEVELS	C	-----	A	A	A OR C
7697-37-2 NITRIC ACID		VERY LOW EXPOSURE LEVELS	A	C	D	D	-----
.2-52-5 NITROMETHANE			B	A	D	D	-----
144-62-7 OXALIC ACID		VERY LOW EXPOSURE LIMIT	C	-----	D	B	B OR C
127-18-4 PERCHLORO-ETHYLENE	PERC		B	A	C	D	-----
7664-38-2 PHOSPHORIC ACID		VERY LOW EXPOSURE LIMIT	B	C	B	B	B OR C
7723-14-0 PHOSPHORUS (YELLOW)		VERY LOW EXPOSURE LEVELS	C	-	A	A	A OR C
1310-58-3 POTASSIUM HYDROXIDE	ENTEC 351 ENTEC 356	LOW EXPOSURE LIMIT	B	A	D	D	-----

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
109-60-4 PROPYL ACETATE	n-PROPYL ACETATE		B	A	C	B	B OR C
107-98-2 PROPYLENE GLYCOL			B	A	D	C	-----
310-73-2 SODIUM HYDROXIDE	CAUSTIC	LOW EXPOSURE LIMIT	B	A	D	C	-----
108-46-3 RESORCINOL	HYDROQUINONE 123-31-9	LOW EXPOSURE LIMIT	B	A	D	B	B OR C
8052-41-3 STODDARD SOLVENT			B	A	B	B	B OR C
100-42-5 STYRENE			B	A	B	C	-----
7664-93-9 SULFURIC ACID		VERY LOW EXPOSURE LIMIT	A	C	D	C	B OR C
109-99-9 TETRAHYDRO-FURAN			B	A	C	C	-----

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108-88-3 TOLUENE			B	A	C	D	-----
79-01-6 TRICHLORO-ETHYLENE	TRI		B	A	C	D	-----
121-44-8 TRIETHYLAMINE		LOW EXPOSURE LEVEL	A	D	D	C	-----
25551-13-7 TRIMETHYL BENZENE	C-9 PANALENE SOLV G		B	A	B	D	-----
8032-32-4 VM & P	NAPHTHA		B	A	B	B	B OR C
1330-20-7 XYLENE	A-595 DuPONT T-245 CI 6-A A-6587 A-6976 A-596 A-7505 C-9		B	A	B	D	-----

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ALFOL 6	1-HEXANOL		B	A	A	A	A OR C
68477-31-6 AMOCO A-575			B	A	A	A	A OR C
AMOCO A-595	SUBSTANCES INCLUDED 1330-20-7 XYLENE		B	A	B	D	-----
ᐧMOCO A-6604	INCLUDED 8008-20-6 KEROSENE		B	A	B	B	B OR C
AMOCO A-6603	SUBSTANCES INCLUDED 8008-20-6 KEROSENE		B	A	B	B	B OR C
AMOCO A-6605	SUBSTANCES INCLUDED 8008-20-6 KEROSENE		B	A	B	B	B OR C
AMOCO A-5470	SUBSTANCES INCLUDED 8008-20-6 KEROSENE		B	A	B	B	B OR C
AMOCO A-6976	SUBSTANCES INCLUDED 1330-20-7 XYLENE 2551-13-7 TRIMETHYLBENZENE 98-82-8 CUMENE	SKIN	B	A	B	D	-----
AMOCO A-8065	SUBSTANCES INCLUDED 91-20-3 NAPHTHALENE	LOW EXPOSURE LEVELS	B	A	B	D	-----

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
AMOCO A-5455	8012-95-1 OIL MIST MINERAL	LOW EXPOSURE LIMIT	C	-----	A	A	A OR C
AMOCO A-6444	8012-95-1 OIL MIST MINERAL	LOW EXPOSURE LIMIT	C	-----	A	A	A OR C
AMOCO A-596	SUBSTANCES INCLUDED 1330-20-7 XYLENE		B	A	B	D	-----
AMOCO 182			B	A	A	A	A OR C
AMOCO A-160			B	A	A	A	A OR C
477-31-6 .OCO A-6706			B	A	A	A	A OR C
68477-31-6 AMOCO A-6714			B	A	A	A	A OR C
AMOCO 8091	SUBSTANCES INCLUDED 26952-21-6 ISO-OCTYL ALCOHOL 91-20-3 NAPHTHALENE 2551-13-7 TRIMETHYLBENZENE	LOW EXPOSURE LEVELS SKIN	B	A	B	D	-----
AMOCO A-7505	SUBSTANCES INCLUDED 1330-20-7 XYLENE		B	A	B	D	-----
64742-94-5 AMOCO SOLV G	SUBSTANCES INCLUDED 91-20-3 NAPHTHALENE 2551-13-7 TRIMETHYLBENZENE	LOW EXPOSURE LEVELS	B	A	B	D	-----
ANTI-FOAM	AFS		B	A	A	A	A OR C
61790-33-8 'EENT	AMMONIA - LOW EXPOSURE LIMIT	FIRE FREES 7664-41-7 AMMONIA	A	D	D	D	A OR C
17194-00-2 BARIUM OCTAHYDRATE	MOD. WATER SOLUBLE	BARIUM - LOW EXPOSURE LIMIT	C	-----	A	B	B OR C
BARQUAT MS-100		SKIN	-	-	D	A	A OR C

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
100-51-6 BENZYL ALCOHOL			B	A	A	B	B OR C
000-111-762 BUTYL CELLOSOLVE			B	A	B	C	-----
112-07-2 BUTYL CELLOSOLVE ACETATE			B	A	B	C	-----
20427-59-2 COPPER HYDRATE		DUST	C	-	A	A	A OR C
DIBASIC ESTER	SUBSTANCE INCLUDES 74-90-8 HYDROGEN CYANIDE		A	C	A	B	B OR C
96-13-9 DIBROMO-PROPANOL	QUACOOR 1220 FR RESIN		B	A	A	B	B
DU PONT DCI 6A	SUBSTANCE INCLUDES 1330-20-7 XYLENE 100-41-4 ETHYL BENZENE		B	A	C	D	-----
ENTEC 733			C	-----	A	A	A OR C

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
ENTEC 321			B	A	A	A	A OR C
ENTEC 327	SUBSTANCES INCLUDED 64-17-5 ETHYL ALCOHOL 67-63-0 ISOPROPYL ALCOHOL		B	A	D	B	B OR C
ENTEC 947	SUBSTANCES INCLUDED 100-37-8 DIETHYLAMINO-ETHANOL 108-91-8 CYCLOHEXYLAMINE	SKIN LOW EXPOSURE LIMIT	A	A	C	D	-----
ENTEC CPS-2	SUBSTANCES INCLUDED 107-15-3 ETHYLENEDIAMINE	LOW EXPOSURE LIMIT	B	A	D	C	-----
ENTEC 356	SUBSTANCES INCLUDED 1310-58-3 POTASSIUM HYDROXIDE	LOW EXPOSURE LIMIT	B	A	D	D	-----
ENTEC 717			B	A	A	A	A

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ENTEC CPS-6	SUBSTANCES INCLUDED 107-15-3 ETHYLENE DIAMINE	LOW EXPOSURE LIMIT	B	A	D	C	-----
ENTEC 234	SUBSTANCES INCLUDED 8012-95-1 OIL MIST(MINERAL)	LOW EXPOSURE LIMIT	C	-----	A	A	A OR C
ENTEC 352	SUBSTANCES INCLUDED 1310-58-3 POTASSIUM HYDROXIDE	LOW EXPOSURE LIMIT	B	A	D	D	-----
ENTEC 351	SUBSTANCE INCLUDES 1310-58-3 POTASSIUM HYDROXIDE	LOW EXPOSURE LIMIT	B	A	D	D	-----
2-ETHYLHEXOIC ACID			B	C	B	B	B OR C
64742-54-7 EXXON 150	OIL MIST	LOW EXPOSURE LEVEL	C	-----	A	A	A OR C
64742-54-7 EXXON 600	OIL MIST	LOW EXPOSURE LIMIT	C	-----	A	A	A OR C

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SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
FB-905	SUBSTANCES INCLUDED 98-00-0 FURFURYL ALCOHOL 50-00-0 FORMALDEHYDE	SKIN VERY LOW EXPOSURE LIMIT SUSPECTED CARCINOGEN	A	C	C	B	B OR C
-905-21	SUBSTANCES INCLUDED 98-00-0 FURFURYL ALCOHOL 50-00-0 FORMALDEHYDE 108-46-3 RESORCINOL	SKIN VERY LOW EXPOSURE LEVEL SUSPECTED CARCINOGEN	A	C	C	B	B OR C
FB-963	SUBSTANCES INCLUDED 98-00-0 FURFURYL ALCOHOL 50-00-0 FORMALDEHYDE	SKIN VERY LOW EXPOSURE LIMIT SUSPECTED CARCINOGEN	A	C	C	B	B OR C
124-09-4 HMDA		FIRE FREES AMMONIA LOW EXPOSURE LIMIT	A	D	D	D	-----

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B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

RTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRAY)
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
HMDA 3PO	WELL CHEM 1500	FIRE FREES AMMONIA	A	D	D	D	-----
68-526-83-0 ISO-OCTYL ALCOHOL	A-8091	SKIN	B	A	D	A	A OR C
8008-20-6 KEROSENE	A-6603 A-6605 MOBILARMA 246 or 247 A-6604 A-5470		B	A	B	B	B OR C
KOLD CURE 1-M	Substances INCLUDED 98-00-0 FURFURYL ALCOHOL	SKIN LOW EXPOSURE LIMIT	B	A	C	B	B OR C
MARKER-MP	SUBSTANCE INCLUDES 91-20-3 NAPHTHALENE	LOW EXPOSURE LEVELS	B	A	B	D	-----
109-86-4 METHYL CELLOSOLVE			B	A	D	C	-----
64742-47-8 MINERAL SPIRITS			B	A	B	D	-----
NALCO 5451	SUBSTANCE INCLUDES 64742-94-5 NAPHTHA 91-20-3 NAPHTHALENE	LOW EXPOSURE LEVELS	B	A	B	D	-----
MOBILARMA 246 OR 247	SUBSTANCE INCLUDES 8008-20-6 KEROSENE		B	A	B	B	B OR C
1338-24-5 NAPHTENIC ACID			B	A	C	B	B OR C
33-67-3 CKEL CARBONATE	NICKEL	LOW EXPOSURE LIMIT DUST MOD. WATER SOLUBLE	C	-	A	A	A OR C

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
D - CHEMREL W/BOOTS & HOOD C202 (GRA
E - NEOPRENE JACKET OVERALL & HOOD W/FACE SHIELD

PROTECTIVE BOOTS: A - TYVEK 414 (WHITE)
B - POLYCOATED TYVEK 514 (YELLOW)
C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
373-02-4 NICKEL ACETATE	NICKEL	LOW EXPOSURE LIMIT DUST MOD. WATER SOLUBLE	B	A	A	A	A OR C
25145-52-3 NONYLPHENOL		LOW EXPOSURE LIMIT	A	A	D	B	B OR C
.7-23-4 NUOPENE G-4			C	-----	A	A	A OR C
NYLATE 10	COPPER-8-QUINOLINOLATE		B	A	A	A	A OR C
8012-95-1 OIL MIST (MINERAL)	A-5455 A-6444	LOW EXPOSURE LIMIT	C	-----	A	A	A OR C
112-80-1 OLEIC ACID	UNITOL (TALL OIL FATTY ACID)		C	-----	B	B	B OR C
1333-39-7 PHENOL-SULFONIC ACID			B	C	D	B	B OR C
108-65-6 PM ACETATE			B	A	A	A	A OR C

RESPIRATOR: A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE: A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
D - WILLSON R-24 AMMONIA & AMINE (GREEN)

GLOVES: A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
D - NEOPRENE (BLACK & LABELED)

PROTECTIVE COVERALLS: A - TYVEK 1417 (WHITE)
B - POLYCOATED TYVEK 5417 (YELLOW)
C - SARANEX W/BOOTS 77415 (WHITE)
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C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
25212-86-6 QUACOOR 1300 RESIN	SUBSTANCES INCLUDED 98-00-0 FURFURYL ALCOHOL	SKIN LOW EXPOSURE LIMIT	B	A	C	B	B OR C
QUACORR 1200 FR RESIN	SUBSTANCES INCLUDED 98-01-1 FURFURYL 98-00-0 FURFURYL ALCOHOL 96-13-9 DIBROMOPROPANOL	SKIN LOW EXPOSURE LIMIT	B	A	C	B	B OR C
25212-86-6 QUACOOR 1001	SUBSTANCES INCLUDED 98-00-0 FURFURYL ALCOHOL	SKIN LOW EXPOSURE LIMIT	B	A	C	B	B OR C
23779-32-0 SILANE 1160	SUBSTANCES INCLUDED 67-56-1 METHANOL	SKIN	B	A	D	C	------

RESPIRATOR:
A - WILLSON MODEL 1700 FULL FACE MASK
B - WILLSON MODEL 1200 HALF FACE MASK
C - 8710 NON TOXIC PARTICLE MASK

CARTRIDGE:
A - WILLSON R-21 ORGANIC VAPORS (BLACK)
B - WILLSON R-25 BROMINE, CHLORIDE & ORGANIC VAPORS (YELLOW)
C - WILLSON R-26 FORMALDEHYDE & (WHITE) ACID GASES
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GLOVES:
A - VINYL COATED GAUNTLET (YELLOW OR BLACK)
B - NITRILE RUBBER (BLACK & LABELED)
C - SILVER SHIELD (SILVER)
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PROTECTIVE COVERALLS:
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C - POLYVINYL SLIPOVER (BLACK)
D - NEOPRENE OVERSHOE (TAN)

SUBSTANCE	COMMON NAMES OR MIXTURES	WARNING	RESPIRATOR	CARTRIDGE	GLOVES	PROTECTIVE SUIT	PROTECTIVE BOOT
7681-52-9 SODIUM HYPOCHLORITE	HYPO BLEACH		B	A	A	A	A OR C
SODIUM METHYLATE	SUBSTANCES INCLUDES 67-56-1 METHANOL	SKIN	B	A	D	C	------
64[illegible]8-9 190 [illegible]LVENT			B	A	C	D	------
SULFAMIC ACID			B	A	B	A	A OR C
TOLAD T-245	1330-30-71 XYLENE		B	A	B	D	------
TOLAD T-500	AROMATIC HYDROCARBONS		B	A	B	D	------
104-15-4 TOLUENESULFONIC ACID	PSTA		B	A	D	B	B OR C
112-57-2 TETRAETHYLENE PENTAMINE	TEPA		A	D	D	D	------
61790-12-3 UNITOL	TALL OIL FATTY ACID SUBSTANCE INCLUDES OLEIC ACID 112-80-1		B	C	B	B	B OR C

SECTION E:

MEDICAL SURVEILLANCE PROGRAM

E.) Medical Surveillance Program:

This section addresses the requirement to develop a Medical Surveillance Program for all employees who are or may be exposed to hazardous substances or health hazards at or above established permissible exposure limits for these substances. Also, employees exposed to hazardous substances at concentrations above the permissible exposure limits during emergency situations and employees engaged in hazardous waste operations under RCRA.

The ACS program was developed as shown by the attached correspondence with the Hammond Clinic (E-1, E-2 & E-3). The employees were notified of the program by the management (E-4). Employees are scheduled for medicals and a list is posted prior to the assigned day (E-5).

The frequency of the examinations is as follows:

1.) Prior to assignment for all new employees engaged in plant operations.
2.) At least once every twelve months for each employee engaged in plant operations.
3.) At termination of employment from plant operations if the most recent examination is not within the last six months.
4.) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms indicating possible over-exposure to hazardous substances or health hazards.
5.) At more frequent intervals as specified by examining physician if increased frequency is medically necessary.

The contents of the examination as reflected in the attached correspondence was developed by information submitted by ACS and the expertise of the Industrial and Occupational Medicine Department of the Hammond Clinic. The contents may be modified by any of the on going programs outlined in this plan, regulations, future programs and recommendations by the Hammond Clinic Staff. As these refinements are made, this section will be updated.

Any additional information or changes concerning the following will be forwarded to the Hammond Clinic for review and possible program changes:

1.) Employee duties and/or job descriptions as they relate to the employee's exposure.
2.) Employee's exposure levels or anticipated exposure levels. For example, the results of the Air Monitoring Program (Section F).
3.) Change in any PPE as described in Section D.
4.) Information from previous medicals if not available to the examining physician.

The employees will have access to all information, results, physician's opinions and recommendations generated by this program. Each employee will sign the results in admission of his understanding of the results of the medical examination and any medical conditions which requires further examination or treatment.

The records of the medical surveillance for each employee will be maintained for at least the duration of employment plus thirty (30) years. The records will be individualized and contain the following information:

1.) Employee name and social security number.
2.) Results of the medicals - all information, results, physician's opinions and recommendations.
3.) Any employee medical complaints related to exposure to hazardous substances.
4.) A copy of all the information which was or shall be provided to the examining physician by the employer as reflected in E-1 or additional information as mentioned previously.
5.) A copy of any Personal Injury Report Forms prepared by the Plant Safety Officer concerning the employee.

american Chemical Service, Inc.
TECHNICAL PRODUCTS

P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4369

February 10, 1987

Dr. Robert Guthrie
Director
Industrial - Occupational Medicine
Hammond Clinic
7905 Calumet Avenue
Munster, IN 46321

Re: Developement of a Medical
Surveillance Program at
American Chemical Service, Inc.

Dear Dr. Guthrie,

The purpose of this letter is to provide you with more detailed data concerning the operations conducted at American Chemical Service, Inc. It is our intent that with this data a Medical Surveillance Program can be instituted at ACS in compliance with OSHA 29 CFR Part 1910 (Hazardous Waste Operations and Emergency Response). The following information is provided to the physician as required by law:

1.) A copy of the standard and its appendices. The copy is enclosed.

2.) A description of the employee's duties as they relate to the employee's exposures.

Enclosed is a copy of our Personnel Training for the hazardous waste operations at ACS.

3.) The employee's exposure levels or anticipated exposure levels.

An Air Monitoring Program is being developed at ACS in order to determine the base levels of exposure and the appropriate types of employee protection needed on site. The results will be forwarded to your office upon completion. At this time, a list of the hazardous substances handled at ACS is enclosed for your review.

4.) A description of any personal protective equipment used or to be used.

The following is a list of the personal protective equipment in use at ACS:

A.) Safety Caps
B.) Safety Glasses
C.) Safety Spectacles
D.) Face Shields
E.) Dust & Mist Respirators
F.) Organic Vapor Respirators
G.) Self Contained Breathing Apparatus
H.) Supplied Air Breathing Apparatus
I.) TYVEK Coveralls
J.) Poly Coated TYVEK Coveralls
K.) Aprons
L.) Vinyl Coated Gauntlet Gloves
M.) Hot Mill Cloth Gloves
N.) Rubber Overshoes

5.) Information from previous medical examinations of the employees which is not readily available to the examining physician.

No information is available at this time.

I hope the information enclosed will aid you in developing a Medical Surveillance Program applicable to the operations at American Chemical Service, Inc. If further discussion is necessary please feel free to contact me at 219/924-3144.

Very truly yours,

John J. Murphy

John J. Murphy
Vice President
American Chemical Service, Inc.

JJM/rl

[illegible] time weighted Eight hour average
STEL short period of time 15 min
[illegible] max exposure

LIST OF HAZARDOUS SUBSTANCES

Methyl chloroform 1,1,1, Trichloroethane	TWA 350 ppm	STEL 450 ppm	
trichloroethylene	TWA 50 ppm	STEL 200 ppm	
perchloroethylene tetrachloroethylene	TWA 50 ppm	STEL 200 ppm	
(Car) methylene chloride	TWA 100 ppm	STEL 500 ppm	changing to 50 ppm 8/87
acetone	TWA 750 ppm	STEL 1000 ppm	
xylene	TWA 100 ppm	STEL 150 ppm	
toluene	TWA 100 ppm	STEL 150 ppm	
methyl ethyl ketone	TWA 200 ppm	STEL 300 ppm	
methyl alcohol methanol	TWA 200 ppm	STEL 250 ppm	skin
butyl alcohol			
(Car) formaldehyde	TWA 1 ppm	STEL 2 ppm	
bromine	TWA .1 ppm	STEL .3 ppm	
ethylene diamine	TWA 10 ppm	STEL ————	deleting 8/87
furfural	TWA 2 ppm	STEL (10 ppm) — skin	
formic acid	TWA 5 ppm	STEL ————	
diethylenetriamine	TWA 1 ppm	STEL ————	Skin
maleic anhydride	TWA .25 ppm	STEL ————	
Sulfuric acid	TWA 1 mg/m		
n Butyl alcohol	C 50 ppm TWA	STEL ————	Skin
Sec. " "	TWA 100 ppm	STEL 150 ppm	
tert " "	TWA 100 ppm	STEL 150 ppm	
VMP	TWA 300 ppm	STEL 400 ppm	deleting 8/87
Hydrogen peroxide	TWA 1 ppm		
Hexane	TWA 50 ppm		
Furfuryl alcohol	TWA 10	STEL 15 ppm — Skin	
Sodium Hydroxide	C. TWA 2 mg/m		

Hammond Clinic
7905 CALUMET AVENUE
MUNSTER, INDIANA 46321
PHONE (219) 836-5800

March 20, 1987

Mr. John Murphy
American Chemical Service, Inc.
Post Office Box 190
Griffith, Indiana 46319

RE: Development of a Medical Surveillance Program at American Chemical Service, Inc.

Dear Mr. Murphy:

I hope this letter will be of some assistance in establishing a medical surveillance program at American Chemical Services. I have researched the list of hazardous chemicals to which your employees may be exposed. I have also inspected your facilities and was very impressed with the ongoing on-site surveillance of hazardous waste products. However, I do feel that annual employee physical examinations would enhance your program. These physicals should include testing of the various body systems which could possibly be affected by long or short term exposure. The two organ systems most commonly affected are the respiratory and urinary systems. Therefore, they need to be monitored on an annual basis.

I would recommend the following tests to be included in the annual physical examination for your employees.

Physical examination	22.00
Chest x-ray	48.00
Complete blood count	17.50
Urinalysis	10.00
Pulmonary function tests	15.00
Total	$112.50

I would also recommend that you establish a policy and procedure program for substance abuse. Many companies are now testing employees for substance abuse when there is an industrial accident. If you are interested in this program, please let me know and I can supply you with more information.

Sincerely,

Robert Guthrie D.O.

Robert Guthrie, D.O.
Director
Department of Occupational
Medicine and Emergency Trauma

RG/dg

American Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

April 14, 1987

Dr. Robert Guthrie
Director
Industrial-Occupational Medicine
Hammond Clinic
7905 Calumet Avenue
Munster, IN 46321

Re: Medical Surveillance Program
at American Chemical Service, Inc.

Dear Dr. Guthrie,

Please accept this letter from American Chemical Service (ACS) as authorization for the Hammond Clinic to treat the ACS employees under the ACS Medical Surveillance Program. The outline of tests proposed in your letter March 20, 1987 appears to meet the goals of the surveillance program. At this time, ACS would like to use the existing Hammond Clinic Physical Form and the results will be forwarded to ACS for record keeping. ACS will contact you when the physicals schedule has been formulated so you know when to start expecting ACS employees.

Very truly yours,

John J. Murphy
Vice President
American Chemical Service

JJM/rl

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

April 16, 1987

TO: TO ALL PLANT PERSONNEL

TOPIC: ANNUAL PHYSICAL EXAMINATIONS

A recently enacted federal law requires all individuals who may be exposed to hazardous materials, receive an annual physical examination. The examination will consist of the following:

Physical examination
Chest X-ray
Complete blood count
Urinalysis
Pulmonary function tests

The examinations will be conducted at the Hammond Clinic (7905 Calumet Ave. Munster, IN.) and will be scheduled one to two weeks in advance. Employees will be allowed to leave work 2 hours before the end of their day turn shift. The examination will last approximately 2 hours. Since the company will pay for the entire cost of the examination, the results will remain the property of ACS. Employees may receive a copy of the examination upon request.

The purpose of this examination is not to check for substance abuse rather to determine the general health level of all employees over the term of their employment. Scheduling will begin immediately.

The Management of
American Chemical Service, Inc.

MEDICAL SURVEILLANCE SCHEDULE

DATE: 8 MAY 1987

THE FOLLOWING PERSONS REPORT TO TOM MURPHY AT 8AM ON DATE ABOVE FOR THE AUTHORIZATION PASS FOR MEDICALS. PUNCH IN AND OUT AT 8AM AND PROCEED TO THE HAMMOND CLINIC - IMMEDIATE CARE SECTION. RETURN TO WORK AFTER THE PHYSICAL AND PUNCH IN. EACH PERSON IS SCHEDULED FOR 8 HOURS.

ROBERT VILLARS

JOHN HAMDER

FRED COLE

ERNIE SWINFORD

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

Pre-Employment Examination

To: Examining Physician

Please complete the following form and return with the results of the examination.

Date: ____________________

Person: ____________________

Yes No Can this person wear a respirator?
If no, please explain ____________________.

Yes No Does this person show signs of a previous work related illness?
If yes, please describe ____________________.

Yes No Does this person have a physical condition which would restrict him from working in a chemical facility?
If yes, please describe ____________________.

Yes No Are there any work limitations for this person?
If yes, please list ____________________.

Examining Physician: ____________________.

Thank You,
ACS Safety and Health Officer

American Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

Periodic Medical Examination

To: Examining Physician

Please complete the following form and return with the results of the examination.

Date: ______________________

Employee: ___________________

Yes No Can this employee wear a respirator?
If no, please explain ______________________________.

Yes No Does this employee show signs of a work related illness?
If yes, please describe ____________________________.

Yes No Does this employee have a physical condition which would restrict the employee's job?
If yes, please describe ____________________________.

Yes No Are there any work limitations for this employee?
If yes, please list ________________________________.

Examining Physician: _______________________________

Thank You,
ACS Safety and Health Offic

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

Termination Examination

To: Examining Physician

Please complete the following form and return with the results of the examination.

Date: ______________________

Employee: ___________________

Yes No Does this employee show signs of a work related illness?
If yes, please describe ______________________________.

Yes No Does this employee show any signs of a physical or psychological condition which could be work related?
If yes, please describe ______________________________.

Examining Physician: ______________________________

Thank You,
ACS Safety and Health Officer

SECTION F:

AIR MONITORING PROGRAM

F.) Air Monitoring Program:

This section addresses the requirement to develop an air monitoring program to identify and quantify airborne levels of hazardous substances in order to determine the appropriate level of employee protection needed as referred to in Sections B,D and G.

The first step is to identify if any of the tasks described in Section B involves a IDLH (Immediately Dangerous to Life or Health) and other dangerous situation. For example:

1.) Presence of flammable atmospheres
2.) Oxygen- deficient environment
3.) Toxic levels of airborne contaminants

The presence of a flammable atmosphere would be defined as a LEL (Lower Explosive Limit) of 22% or above. This is measured by the Model MX241 Combustible Gas Monitor.

An oxygen- deficient environment would be any confined area measuring an oxygen percentage at 19.5% or below. This is measured by the use of the Model MX241 Oxygen Monitor.

To measure toxic levels of airborne contaminants, the program must first identify the chemical substances to be found in the work environments at ACS. From the Threshold Limit Value and Biological Exposure Indices for 1986-1987 published by the American Conference of Governmental Industrial Hygienists the attached list has been developed (F-1). Also, from the same indices the Threshold Limit Values for each of the substances on the list are known. These values will be compared to the monitoring results as reflected on the Air Monitoring Work Sheets (F-2).

The equipment used to measure the toxic levels will be purchased as required in stages to define the presences of a risk.

STAGE 1- Each production area handling a substance (s) on the list (F-1) will be monitored for that substance if possible. The measuring devices will be National Draeger detector tubes. The tubes are self-indicating for long and short durations. If a long duration tube is available for a certain substance, the tube will be pumped in the production area with a DuPont Constant Flow Sampler Model P-200 for periods of 4 to 8 hours and results recorded on sheets (F-2). If only short duration tubes are available, a Draeger Model 31 bellows hand pump will be used at times when high concentrations are most likely:

1. Pumping container and transferring operati
2. Filling container operations
3. Emptying container operations
4. Emergency operations

Again the results will be recorded on sheets (F-2). If results are not conclusive (lack of available sampling tubes or inconsistant results) or reflect above threshold limits, Stage 2 monitoring will begin.

STAGE 2- The employees will be fitted with 3M Organic Vapor Monitors (#3500 or #3520). The sample duration will be 7 hours and the results will be analyzed by the ACS lab facilities according to the protocol outlined in the enclosed documentation (F-3). The results will be recorded on sheets (F-2).

If during Stage 1 or Stage 2 basic monitoring conditions in an area reflect above threshold limits, the Site Safety and Health Officer will recommend to ACS changes in PPE or control measures in order to protect the employees working in that area. Also, if an IDLH situation has been detected during monitoring of a confined space, the Site Safety and Health Officer will issue the necessary forms authorizing a Hazardous Atmosphere Entry (Refer to Section K).

The frequency of the Stage 1 or Stage 2 toxic will be determined during the initial survey due for completion 1 September 1987. The flammable atmosphere and oxygen-deficient environment monitoring will be conducted for every confined space entry. If the monitoring shows the space to be an IDLH, the results will be recorded on the Plant Safety Coordinator Checklist (K-1).

The MX241 Combustible Gas Monitor has a field calibration kit with Propane cylinders of both 25% and 50% LEL. The MX241 will be calibrated each time prior to monitoring a confined space. The DuPont Constant Flow Sampler Model P-200 has a Constant Flow Sampler Calibrator which will be used each time prior to a Stage 1 toxic air monitoring sample.

The results of all air monitoring will be recorded and the records will be maintained for 30 years.

Updated 6/90

American Chemical Service Substance List
Table Z-1-A Limits for Air Contaminants

Substance	CAS No.	TWA Limits		STEL Limits		Ceiling		Skin
		ppm	mg/m3	ppm	mg/m3	ppm	mg/m3	
ACETIC ACID	64-19-7	10	25					
ACETIC ANHYDRIDE	108-24-7					5	20	
ACETONE	67-64-1	750	1800	1000	2400			
ACETONITRILE	75-05-8	40	70	60	105			
AMMONIA	7664-41-7			35	27			
n-AMYL ACETATE	628-63-7	100	525					
BARIUM SOLUBLE COMPOUNDS	7440-39-3		0.5					
BENZENE	71-43-2	10		50(A)		25		
BROMINE	7726-95-6	0.1	0.7	0.3	2			
n-BUTYL ACETATE	123-86-4	150	710	200	950			
sec-BUTYL ACETATE	105-46-4	200	950					
n- YL ALCOHOL	71-36-3					50	150	X
sec-BUTYL ALCOHOL	78-92-2	100	305					
CALCIUM HYDROXIDE	1305-62-0		5					
CALCIUM OXIDE	1305-78-8		5					
CARBON DISULFIDE	75-15-0	4	12	12	36			X
CARBON TETRACHLORIDE	56-23-5	2	12.6					
CHLOROBENZENE	108-90-7	75	350					
CUMENE	98-82-8	50						
CYCLOHEXANE	110-82-7	300	1050					
CYCLOHEXYLAMINE	108-91-8	10	40					
DIACETONE ALCOHOL	123-42-2	50	240					
-DIETHYLAMIN-ETHANOL	100-37-8	10	50					X
IETHYLENE RIAMINE	111-40-0	1	4					
-ETHOXYETHANOL	110-80-5	200	740					X
TI ACETATE	141-78 6	400	1000					

American Chemical Service Substance List
Table Z-1-A Limits for Air Contaminants

Substance	CAS No.	TWA Limits ppm	TWA Limits mg/m3	STEL Limits ppm	STEL Limits mg/m3	Ceiling ppm	Ceiling mg/m3	Skin
ETHYL ACETATE	141-78-6	400	1400					
ETHYL ALCOHOL	64-17-5	1000	1900					
ETHYL BENZENE	100-41-4	100		125				
ETHYL ETHER	60-29-7	400	1200	500	1500			
ETHYLENEDIAMINE	107-15-3	10	25					
ETHYLENE DICHLORIDE	107-06-2	1	4					
ETHYLENE GLYCOL	107-21-1					50	125	
FORMALDEHYDE	50-00-0	3		10(B)		5		
FORMIC ACID	64-18-6	5	9					
FURFURAL	98-01-1	2	8					X
FURFURYL ALCOHOL	98-00-0	10	40	15	60			X
GASOLINE	8006-61-9	300	900	500	1500			
HE[illegible]NE	142-82-5	400	1600	500	2000			
HEXANE	110-54-3	50	180					
HEXANE ISOMERS	VARIES	500	1800	1000	3600			
HEXYLENE GLYCOL	107-41-5					25	125	
HYDROGEN CYANIDE	74-90-8			4.7	5			X
HYDROGEN PEROXIDE	7722-84-1	1	1.4					
HYDROQUINONE	123-31-9		2					
ISOBUTYL ALCOHOL	78-83-1	50	150					
ISO-OCTYL ALCOHOL	68526-83-0	50						X
ISOPHORONE	78-59-1	4	23					
ISOPROPYL ACETATE	108-21-4	250	950	310	1185			
ISOPROPYL ALCOHOL	67-63-0	400	980	500	1225			
MALEIC ANHYDRIDE	108-31-6	0.25	1					
METHANOL	67-56-1	200	260	250	310			X
METHYL CHLOROFORM	71-55-6	350	1900	450	2450			

American Chemical Service Substance List
Table Z-1-A Limits for Air Contaminants

Substance	CAS No.	TWA Limits ppm	TWA Limits mg/m3	STEL Limits ppm	STEL Limits mg/m3	Ceiling ppm	Ceiling mg/m3	Skin
METHYLCYCLOHEXANE	108-87-2	400	1600					
METHYLENE CHLORIDE	75-09-2	500		2000(C)		1000		
METHYL ETHYL KETONE	78-93-3	200	590	300	885			
METHYL ISOBUTYL KETONE	108-10-1	50	205	75	300			
NAPHTHA	64742-94-5					100		
NAPHTHALENE	91-20-3	10	50	15	75			
NICKEL-SOLUBLE COMPOUNDS	7440-02-0	0.1						
NITRIC ACID	7697-37-2	2		4				
NITROMETHANE	75-52-5	100	250					
OIL MIST MINERAL	8012-95-1	5						
OX[illegible]C ACID	144-62-7		1		2			
PER[illegible]LOROETHYLENE	127-18-4	25	170	300(D)				
PHOSPHORIC ACID	7664-38-2		1		3			
POTASSIUM HYDROXIDE	1310-58-3						2	
PROPYLENE GLYCOL	107-98-2	100	360	150	540			
SODIUM HYDROXIDE	1310-73-2						2	
STODDARD SOLVENT	8052-41-3	100	525					
STYRENE MONOMER	100-42-5	50	215	100	425			
SULFURIC ACID	7664-93-9	1000	6000					
TETRAHYDROFURAN	109-99-9	200	590	250	735			
TOLUENE	108-88-3	100	375	150	560			
TRICHLOROETHYLENE	79-01-6	50	270	200	1080			
TRIETHYLAMINE	121-44-8	10	40	15	60			
TRIMETHYL BENZENE	25551-13-7	25	125					
VM & P NAPHTHA	8032-32-4	300	1350	400	1800			
WELDING FUMES (NOC)			5					
XY[illegible]E	1330-20-7	100	435	150	655			

(A.) Maximum Duration 10 minutes

(B.) Maximum Duration 30 minutes

(C.) Maximum Duration 5 minutes in any 2 hours

(D.) Maximum Duration 5 minutes in any 3 hours

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P.O. Box 190 • Griffith, Indiana 46319
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DATE: December 13, 1988

TO: ACS Employees Conducting Air Monitoring

TOPIC: Air Monitoring Theory and Procedures Utilizing Draeger Detector Tubes

The following covers the outline of the Air Monitoring Program used by ACS. Specifically this part of the program directs itself to the use of the Draeger long and short duration detector tubes. Discussed are the theories and procedures required to implement a successful program. This outline will be the bases for the training of all ACS employees participating in the Air Monitoring program.

INTRODUCTION

Industrial Hygiene is concerned with the recognition, measurement, evaluation, and control of hazards in the workplace. An integrated approach to worker protection should apply each of these disciplines in a logical progression.

A program has little value unless it starts with a firm recognition that every work situation can have some potentially harmful effect on employees. The hazards range from physical phenomena such as noise, heat, radiation, etc. to chemical exposures to gases, vapors, and particulate matter.

Airborne hazards of importance to industrial hygiene and occupational health can be grouped into categories according to whether they are particulates, vapors, or gases.

Airborne particulates are defined as solid or liquid particles suspended in air. The size of airborne particles can range from individual molecules to particles approximately 100 micrometers in diameter (micrometer = micron = μm).

1 micrometer = 1 millionth of a meter (10^{-6}M). The head of a pin is approximately 1000 μm in diameter. The smallest airborne particle visible to the naked eye is in the range of 50 micrometers.

Airborne particulates can be further categorized as dusts, fibers, fumes, and mists. Airborne dusts are solid particles introduced into the air by mechanically breaking up hard solids. Sanding, grinding, and crushing are examples of operations which generate airborne dust. Windstorms in dry areas can generate large amounts of particulate matter.

Small airborne particles, usually 5 micrometers or smaller, can also get deep into the respiratory system. Usually particles larger than 10 μm in diameter are caught on the mucous membranes of the nose and throat. Smaller particles can find their way beyond these defenses to the lung. Examples of airborne dusts regulated by CFR 1910.1000 are silica, carbon black, and Portland cement.

Airborne fibers are solid particles which have a length several times as great as their diameter. Due to their elongated regular shape and aerodyanamic properties, fibers with lengths much longer than 10 μm may be inhaled into the lung. Ordinarily, particles of this size (10 μm) would be caught in the nasal passages. Examples of regulated airborne fibers are asbestos, talc (fibrous), and tremolite.

Fumes, which are not to be confused with gases or vapors, are very small particles 0.001 to 1 μm in diameter which are usually introduced into the air from molten metal. Generally, the fume particles that remain airborne tend to agglomerate (bunch together) to form larger particles. Settled fume particles which are reintroduced into the air by air currents or vibration are usually of much larger particle size, and appear as particulate matter from polishing or fine grinding operations at metal mines.

Fumes can be formed from materials other than metals, for example, from polytetrafluorethylene (Teflon).

Because of their extremely small size and long resonance time in the atmosphere if not collected, fumes can easily be inhaled.

Examples of fumes regulated by CFR 1910.1000 are cadmium fume, copper fume, zinc oxide fume, and iron oxide fume. Note these fumes are frequently generated by welding or by hot dipcoating of parts.

Also, scrap burners who prepare miscellaneous scrap for remelt generate many types of fumes due to the protective metal coatings that are used.

A mist is made up of airborne droplets of a substance which are liquid at room temperature. The droplets usually result from boiling, bubbling, splashing, spraying, etc., and from condensation of vapors from the liquid.

Individual mist droplets may vary widely in size from less than 0.01 μm to over 10 μm in diameter. Mist droplets or particles are usually spherical in shape.

Industrial pesticides are usually mists propelled by compressed gas. Examples of mists regulated by CFR 1910.1000 are oil mists, sulfuric acid mist, and copper mist.

In the broadest sense of the word, gas refers to one of the three physical states--solid and liquid being the other two--that a substance can exist in. More specifically however, it is used to describe a pure substance or mixture that occupies the gaseous state under normal temperature and pressure conditions.

Gases in their pure forms have varying densities. In situations of importance to industial hygiene, gases can usually be assumed to escape or leak from their source and mix with air according to their specific gravity and relative temperature.

If the gas entering the air is extremely cold, it may settle initially and then diffuse as it warms. Similarly, if the gas is hot, it may rise rapidly and then diffuse. If the gas is light, like hydrogen, it may rise. If the gas is heavy, like propane, it may sink to the lowest level and accumulate until disturbed by air currents. Carbon dioxide can fill low spots and create oxygen deficiency.

Examples of gases regulated by CFR 1910.1000 are sulfur dioxide, ozone, phosgene, chlorine, hydrogen sulfide and carbon monoxide.

Vapors are the gaseous form of materials which are liquids or solids at room temperature. Vapors behave much as do gases in the atmosphere, but will condense to form mists or fogs as they cool or as pressure increases.

The evolution of vapors from volatile liquids and solids may increase rapidly with increase in temperature or decrease in pressure.

Examples of vapors regulated by CFR 1910.1000 are benzene, methyl alcohol, methyl ethyl ketone (MEK), styrene, toluene, trichloroethylene, mercury, and vinyl chloride.

Recognition of potential hazards begins with a complete familiarization with all of the operations and processes in the plant. This includes a catalog of all chemicals used or produced, the processes involved, and their location. In addition, the health effects of exposure, whether they be acute or chronic and the permissible exposure levels for each contaminant must be known. This information, in combination with observed work routine, determines whether the work situation is hazardous. Whether or not exposure to a toxic substance constitutes a hazard depends on many factors:

- Concentration of the toxic contaminant
- Duration of exposure
- Individual susceptibility
- Health and hygiene practices

Once a potential hazard is recognized, the next step is to devise a measurement plan to establish the intensity and duration of exposure. Some basic decisions to be made are:

- Where to sample?
- How long to sample?
- Do you need long-term average concentration or is an estimate of peak level required?
- How many samples are required to satisfy statistical criteria?
- Is the sample to be an area sample or does it need to be a breathing zone sample on a person?
- If it is a personal sample, which persons have the higher potential risk?

These and other factors are addressed in the IUPAC Commission for the Atmospheric Environment article entitled "Sampling Plan for Gases and Vapors in Working Areas" (see appendix, article 1). From this article, it is obvious that there is a wide range of monitoring methods available. For short-term measurements, the detector tube method is by far the most popular. Detector tubes permit a simple, cost-effective, direct analysis for more than 300 gases and vapors. Draeger tubes in particular are designed for maximum selectivity and sensitivity to the gas being measured. Even complex mixtures of contaminants can be analyzed using a prescribed routine (See copy of Draeger Review article "Qualitative Detection of Substances by means of Draeger Detector Tube Polytest and Draeger Detector Tube Ethyl Acetate 200/a" Draeger Review #46, pages 13 - 21) (see appendix, article 2).

The simplicity of this method is apparent in that in many instances the only equipment required is a sampling pump (Draeger Model 31 Bellows Pump) and the tube designed to measure the gas or vapor in question. This system even makes detection of aerosols simple. Until Draeger developed the first aerosol tube, there were no direct reading instruments available for the analysis of aerosols. The Draeger direct reading aerosol detector tubes operate by collection of the aerosol on a suitable medium within the tube, followed by elution with a suitable solvent, to yield a direct reading colorimetric reaction. An excellent discussion of the construction of these tubes is in the enclosed article by Leichnitz and Walton (see appendix, article 3).

Long-term measurement of air contamination has traditionally been performed by one of two techniques.

1. Collection of a sample in a suitable medium followed by analysis of the substance using standard laboratory techniques. Examples of this technique include pumping air through glass impingers containing a collection liquid, or through charcoal or silica gel tubes. The adsorbed material is chemically desorbed and analyzed via spectroscopic or chromatographic instruments. This is a somewhat time-consuming process but as in the case of long-term measurement for organic solvents, it is unavoidable. Draeger does have both charcoal and silica gel tubes available for use with a suitable sampling pump.

2. Another technique of particular value for evaluating long-term exposure to organic vapors, is to use passive samplers. The samplers use no pump, but depend on the natural diffusion of substances in air for collection of the sample. Analysis of the adsorbed material is generally done by gas chromatography.

By far, the major expense, in both time any money, in long-term measurement is the analysis of the collected sample. Draeger research has produced two alternatives which eliminate the need for post-sampling analysis in the laboratory.

1. Draeger has developed a series of long-term detector tubes, which when used in combination with a low flow pump such as the Polymeter, provide an on-the-spot indication of the integrated concentration over the time period immediately after the sampling is terminated. Since the tubes are direct reading, the accumulated dose of the contaminant is visible at any time during the testing.

   The Polymeter uses precalibrated tubing in a peristaltic pump to pull a precise amount of air through the detector tubes. Flow rates are in the range of 10 - 20 ml/min. The tubes are calibrated in microliters and the average concentration is calculated by dividing the indication (microliters) by the volume of sample in liters to give the average concentration in parts per million (ppm). Two comprehensive articles by Kurt Leichnitz give many of the potential applications for the long-term detector tube system (Draeger Review #40, pages 9 - 17 (see appendix, article 4) and Draeger Review #43, pages 6-13) (see appendix, article 5). These tube systems can be used as an area monitor as well as a personal monitor. As of January 1987, there are 31 long-term tubes available for a variety of contaminants.

2. A second method, which has recently received a great deal of attention, uses the Diffusion Detector Tube. As a direct result of the interest in this area, Draeger research has produced 13 different diffusion tubes as of July 1986 and several more are currently being developed. Operating on the principle of diffusion, these tubes do not require an external pumping device and may simply be clipped to an individual's clothing or placed in the area to be monitored. For an in-depth discussion on this method, please refer to the articles submitted by Pannwitz in Draeger Review #52, pages 1-8 (see appendix, article 6) and Draeger Review #53, pages 10-14 (see appendix, article 7).

In addition to these methods of gas detection, one may also choose a direct reading instrument to continuously monitor various gases. As of May 1984, National Draeger has added to their instrument product line the full range of Ecolyzer portable and fixed gas detection and monitoring system products. An instrument section has been added to this edition of the Application File, so as to provide our customers with a much more complete source of gas analysis techniques. We have also added instruments manufactured by Draegerwerk of Germany and Draeger Ltd., our sister company in the U.K.

Once the concentrations are measured, they must be compared with acceptable standards to determine whether the hazard requires control. Most commonly used are the Threshold Limit Values (TLV) established by the American Conference of Governmental Industrial Hygienists. Three types of permissible levels are published.

1. TLV-TWA: the Time Weighted Average concentration for a normal 8-hour workday and a 40-hour workweek, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect. This is the most commonly used TLV. As an example, the TLV-TWA for ammonia is 25 ppm.

2. TLV-STEL: the Short Term Exposure Limit is the maximum concentration permitted for a 15 minute period with a maximum of four exposures per day with at least one hour between such exposures. The TLV-STEL for ammonia is 35 ppm.

3. TLV-C: the Ceiling concentration which should not be exceeded even instantaneously during any part of the working exposure. This designation is used for substances which are so irritating or toxic that it is imperative that no worker should be exposed to concentrations above the recommended ceiling limit. The TLV-C for hydrochloric acid (HCl) is 5 ppm.

Note should be made of the units of measure used to describe contaminant concentrations. For gases and vapors the units are usually on a volumetric basis and are usually parts per million (ppm) or percent (%) by volume. One ppm refers to one liter of contaminant in one million liters of air. One percent is one liter of contaminant in one hundred liters of air. These two units are closely related and can be converted using the formula below.

$$\text{PPM (vol.)} = \frac{\text{Liters of contaminant}}{\text{1 million Liters of air}}$$

$$\text{Percent (vol.)} = \frac{\text{Liters of contaminant}}{\text{100 Liters of air}}$$

$$\text{PPM (vol.)} = \text{Vol. Percent} \times 10{,}000$$

Another unit of measure used mostly for particulate air contaminants is milligrams per cubic meter (mg/m^3), a mixed unit of weight/volume. Conversion to ppm by weight is done using the following formula, where MW is the molecular weight of the substance being measured.

$$\text{PPM} = \frac{mg}{m^3} \times \frac{24.5}{MW}$$

When on the basis of measurements it is verified that a hazard exists, various options for control are available. Industrial hygienists tend to use the options below in the order they are listed. At first glance, they appear to be in order of increasing expense, but the monitoring requirements for administrative control could easily exceed the cost of good, functional protective equipment.

I. ADMINISTRATIVE CONTROL

This method of control involves an adjustment of the work schedule or work location so that the integrated exposure does not exceed the permissible TWA. For example, the TLV-TWA for carbon monoxide is 50 ppm. If a work station normally has a carbon monoxide level of 80 ppm, then a worker must be removed to an area free of carbon monoxide after five hours. If the lowest level available is 40 ppm, then the permissible time at the level of 80 ppm is two hours and at the low level six hours. Basically, this reflects the idea that the total dose is what is most important. The equation below is used to make the calculations.

$$T1C1 + T2C2 + T3C3 \ldots\ldots = 8\ TWA$$

T1, T2, and T3 represent the time spent at concentration C1, C2, and C3, respectively. TWA is the TLV-TWA and is to be multiplied by 8, which is the number of hours in an average work shift.

This equation is valid provided that the TLV-STEL or TLV-C is not exceeded. In the example of carbon monoxide above, the TLV-STEL is 400 ppm, therefore there is no problem other than the disruption of work schedules. The burden of proof is placed on the employer to show that any exposure is within the specified limits. This alternative therefore, is not inexpensive and, in addition, it has the highest degree of risk.

II. ENGINEERING CONTROL

This method is concerned with "engineering out" the hazard to within acceptable concentration levels. It is the route preferred by OSHA and its inspectors, but is not necessarily the method preferred by those who must comply with the regulations.

A. SUBSTITUTION

The idea behind this method is to exchange a less toxic material for one whose level is too high to comply with regulations. An example of successful applications of this is the substitution of 1,1,1-trichloroethane with a TLV-TWA of 350 ppm in degreasing equipment where trichloroethylene (TLV-TWA: 50 ppm) had previously been used. In contrast, those areas containing a substance to be used for its specific chemical properties generally are unable to substitute. As an example, it is not feasible to substitute acetaldehyde (TLV-TWA: 100 ppm) for formaldehyde (TLV-C: 2 ppm) in the manufacturing of methyl alcohol since the reduction product would be ethyl alcohol rather than methyl alcohol.

B. PROCESS CHANGE

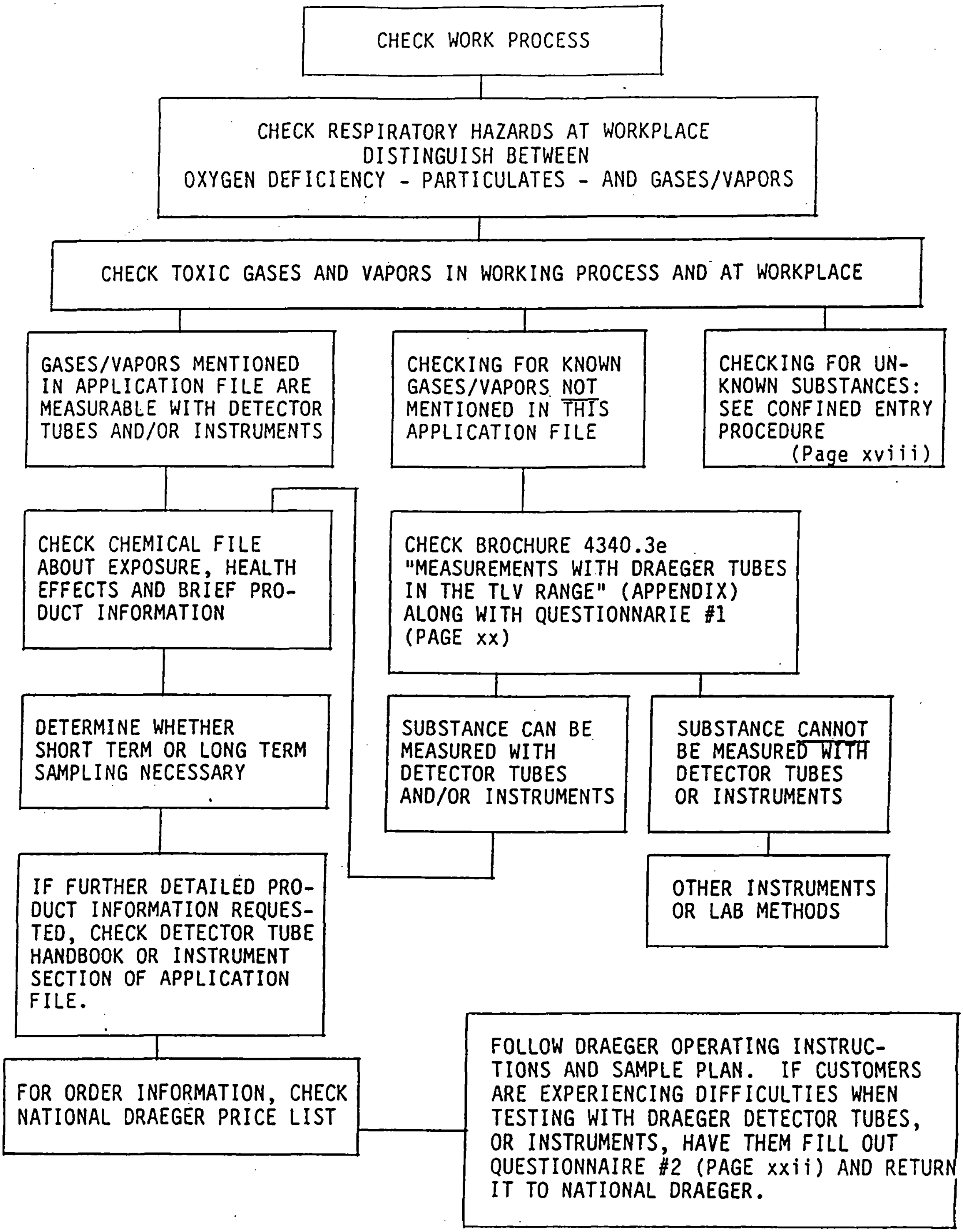
Sometimes it is possible to use a different process to achieve the same product but, in a much less hazardous way. A simple example would be the use of an abrasive slurry in water rather than sand blasting to prepare a surface for finishing. Another simple process change which eliminates worker exposure to lead, is to join electrical components by crimping rather than soldering. Generally, batch processes which can be automated into continuous production processes, result in much lower exposure for fewer workers.

devices, normally for short term use. They must be used as the primary control measure in operations where none of the engineering methods described are totally effective. The best example is a situation where the substance involved is so toxic that even the best ventilation design cannot prevent worker exposure. In this case, the logical employer will use respiratory protection to protect his workers from potentially harmful exposure.

It should be emphasized that the usage of life supporting protective breathing equipment must be accompanied by proper maintenance of the apparatus and training of the user.

AN APPROACH TO DETECT TOXIC GASES AND VAPORS

*****



CONFINED SPACE ENTRY PROCEDURES

and

DETECTION OF UNKNOWN GASES AND VAPORS

The following procedure has been designed for persons entering a confined area who must determine whether a hazard exists.

Prior to entry, the confined space must be tested for oxygen and combustibles. The percentage of oxygen must be not less than 19.5% and no greater than 21% at 1 atm. pressure. Atmospheric air contains 21 Volume % Oxygen. At the lower limit (19.5%) workers are susceptible to oxygen deficiency and are thus required to wear respiratory protection. A slight enrichment, e.g. to 25 volume % causes more intense combustion. With 27% oxygen an intense flame develops from a faint glow. In addition to testing the oxygen level, combustible gases must be measured. If the level of combustibles exceed 10% of the lower flammability limit (LFL), all forms of hot work (e.g. welding) are prohibited.

NIOSH recommends continuous monitoring of both conditions if the confined space is designated Immediately Dangerous to Life or Health (IDLH). This may be accomplished with a reliable analyzer, such as the ECOLYZER 60-400 for oxygen and combustibles.

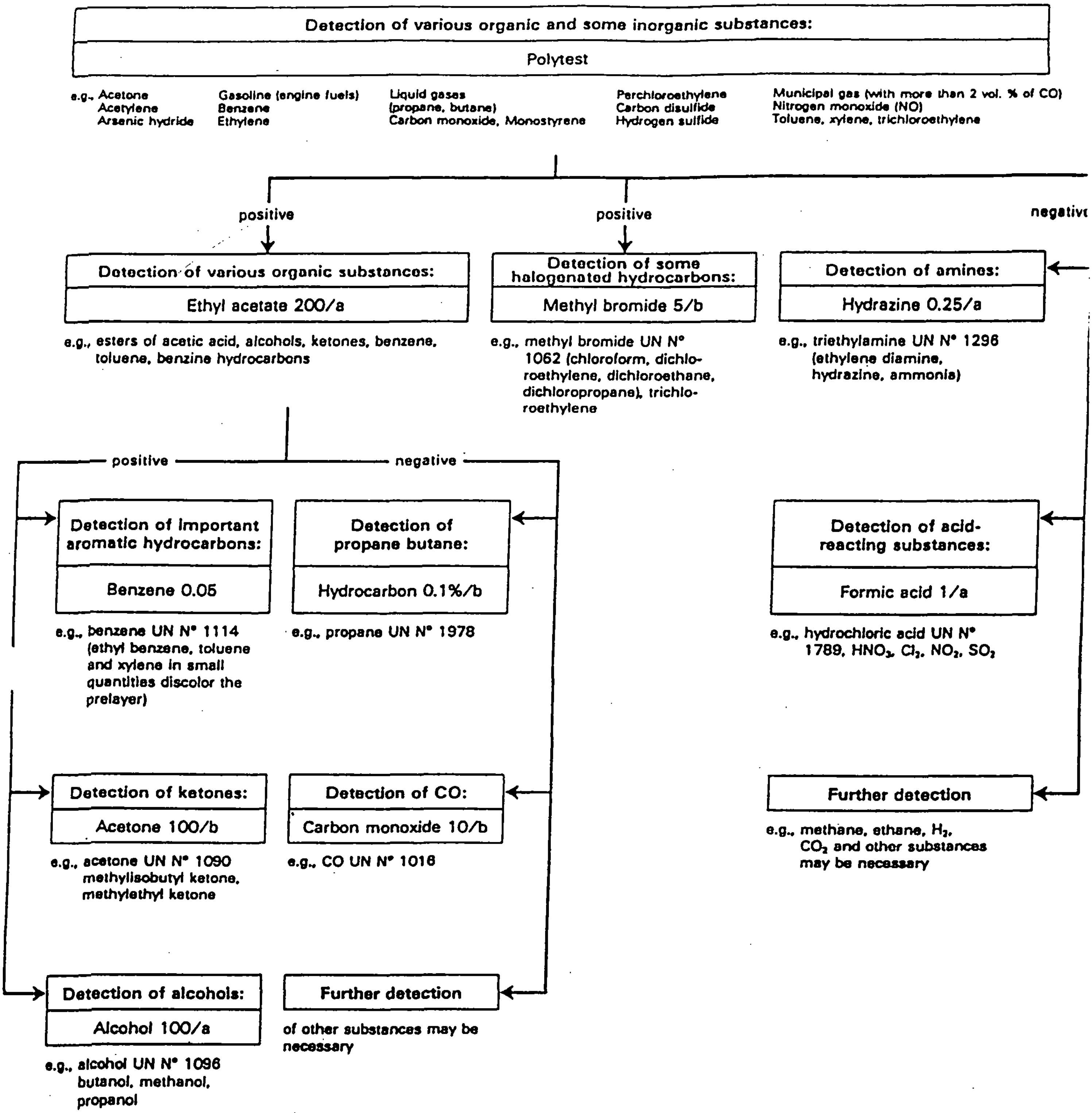
Once these two factors have been determined, one must then test for toxic substances. Often times, the presence and nature of a toxic compound is questionable. Therefore, we suggest the application of a qualitative screening tube - the POLYTEST.

The POLYTEST tube is simply connected to a Draeger Bellows Pump directly, or via an extension hose, and five pump strokes are then applied. If a positive indication is obtained, one then begins a process of elimination with the specific detector tubes. The sampling scheme on the following page was designed to be applicable in the majority of situations encountered.

As a final test, there are several gases the Polytest will not detect. These gases include amines, acid-reacting substances (e.g. hydrochloric acid, nitric acid, sulfur dioxide, etc.), and combustible gases (the levels of which have been previously determined).

The detector tubes listed in the Polytest scheme, in addition to several others are included in the Haz Mat Kit.

Detection of unknown substances by means of DRAEGER detector tubes*



*Important: This sample taking schedule refers to a selection of substances which occur frequently in practice. Other situations may necessitate another sequence of measurements and, the case being, the use of additional detector tubes, or measurements according to other procedures must be carried out.

QUESTIONNAIRE #1

This questionnaire is for customers who have not used detector tubes before for the solution to their measuring problem and want to know whether they can use Draeger detector tubes and if so, which ones.

Check the prospectus 4340.3e, "Measurements with Draeger Tubes in the TLV Range" first and find out whether or not there is a Draeger detector tube available for measuring a given substance. In most cases you will find a specific detector tube, sometimes only non-specific ones, providing a qualitative reading (such as the tube chlorine for chlorine dioxide). If your customer has a special and more complicated problem and you cannot decide whether or not a Draeger detector tube will do the job, obtain as much information as possible using this questionnaire as a guide and then consult with National Draeger (412) 787-8383 or (412) 787-8389. We will try to give you an expedient answer.

National Draeger, Inc.

QUESTIONNAIRE NUMBER ONE

Air and Gas Analyses by means of Draeger Detector Tubes

1. What gas or vapor is to be measured? ______________________

2. What concentration range is to be expected (rough estimate)? ______________________

3. Is ambient air or an industrial gas to be analyzed? ______________________

4. What is the temperature of the gas to be analyzed? ______________________

5. What is the temperature of the ambient air? ______________________

6. What is the air pressure of the ambient air? ______________________

7. If an industrial gas is to be analyzed, does this gas have a higher, lower, or the same pressure as the ambient air? (If possible, state the gas pressure.) ______________________

8. What is the composition of the industrial gas (main components)? ______________________

9. If ambient air is to be analyzed, is this room accessible or does an extension hose have to be used? ______________________

10. If an industrial gas is to be analyzed, is sampling done from a connection nozzle provided for this purpose or is a probe used? ______________________

11. What is the humidity (water vapor content) of the air to be analyzed or of the industrial gas to be analyzed? ______________________

12. In addition to the component to be measured, what other gases and vapors are present? ______________________

13. Supplementary remarks: ______________________

____

____

____

QUESTIONNAIRE #2

This questionnaire is for customers who may be experiencing difficulties when testing with detector tubes. Using questionnaire two as a guide, you should obtain as much information as possible on that customer's application and the testing procedure followed. Consult with the Technical Services Department of National Draeger. The Technical Services Department can then utilize its resources here at National Draeger and, if needed, the Detector Tube Department of Draegerwerk AG in Germany can be consulted.

When used correctly, this service will exhibit a professional approach to solving your customers' problems and strengthen their confidence in the use of detector tube methods.

National
Draeger,
Inc.

QUESTIONNAIRE NUMBER TWO

Air and Gas Analyses by means of Draeger Detector Tubes

Assumption: Draeger Tubes are already used for air or gas analyses.

Brief description of the measuring procedure: ______________________

____

____

____

Please answer the following questions as completely as possible.

1. Which Draeger tubes have been used?

   Type Index: ______________ Order Number: ______________

2. Batch number of the Draeger tubes used? (This number is stamped onto the front or back of the Draeger label glued to the box of tubes). ______________

3. What was the predetermined period of use for the Draeger tubes (shelf life)? ______________

4. Was the Draeger gas detector pump air tight? ______________

5. With how many strokes of the Draeger gas detector pump was the analysis carried out? ______________

6. Which gas or vapor was measured? ______________

7. Which concentrations were determined by means of the Draeger tubes? ______________

8. What was the temperature of the air or gas to be analyzed? ______________

9. What was the temperature of the ambient air at the location of the test? ______________

10. What was the air pressure of the ambient air? ______________

QUESTIONNAIRE NUMBER TWO (Continued)

11. If an industrial gas was analyzed: did this gas have a higher, a lower, or the same pressure as the ambient air? ____________________

12. What was the composition of the industrial gas (main components)? ____________________

13. If ambient air was analyzed: was this room accessible and was it; therefore, possible to place the detector tube directly into the gas detector pump, or was the Draeger extension hose with tube holder used? ____________________

14. If an industrial gas was analyzed: was sampling done by means of the sampling container or a probe? From which material was the probe (the sampling container) made? ____________________

15. What was the humidity of the air that had to be analyzed? ____________________

16. In addition to the component to be measured, what other gases and vapors were present? ____________________

13. Supplementary remarks: ____________________

____

____

____

QUESTIONNAIRE #3

This questionnaire is for customers who may be experiencing diffuculties when selecting proper respiratory protection. Using questionnaire three as a guide, you should obtain as much information as possible on that customer's application. Consult with the Technical Services Department of National Draeger. The technical Services Department can then utilize its resources here at National Draeger to aid the customer in the selection of respiratory protection.

When used correctly, this service will exhibit a professional approach to solving your customers' problems and strengthen their confidences in the Draeger product line.

RESPIRATOR QUESTIONNAIRE

Name and Address of Company ______________________________
____
____

Name of Individual ______________________________
Phone Number ______________________________
Date ______________________________

1. Material protecting against

   a) Chemical Name ____________________
   b) Trade Name ____________________
   c) Formula ____________________

   d) PEL OSHA 1910,1000 ______ Current ACGIH TLV-TWA ______

2. Form in which it will be used

   a) Liquid? ______ b. Solid? ______ c. Gaseous? ______
   d) If gaseous, organic vapor? ______ or acid gas ______

3. Maximum expected concentration

   a) ______________ parts per million or,
   b) ______________ milligrams per cubic meter or,
   c) ______________ Volume %

4. Will material be heated? ______

   a) If so, to what temperature? __________°F

5. Will other materials be encountered? ______________

   a) If yes, please indicate materials____________________

6. Is oxygen deficiency possible? ______________

   a) If yes, what is minimum expected concentration__________

7. Can good ventilation of the area be maintained? __________

8. Will exposure be continuous? ______ or intermittent ______

9. Will the respirator be used for escape only? ____________

10. Please describe in detail work process including equipment and number of people involved.______________________________
____
____
____
____

AIR MONITORING WORK SHEET

DATE:

SAMPLE:

COMPOUND SAMPLED:
OSHA-TWA LIMIT: ppm

LOCATION:

COLLECTION DEVICE:

A. PUMP FLOW RATE: cc/min

B. SAMPLE TIME: minutes

C. AIR VOLUME SUCKED THROUGH= $\frac{A \times B}{1000}$ = liter

D. LONG TERM TUBE INDICATION: u liter

C. AIR VOLUME SUCKED THROUGH: liter

E. MEAN CONCENTRATION = $\frac{D}{C}$ = ppm

3M

Organic Vapor Monitor # 3500

Analysis Guide

ANOTHER STEP TOWARDS BETTER OCCUPATIONAL HEALTH AND SAFETY

70-0701-7371-4(17.2)R2

Litho in U.S.A.

Occupational Health and Safety Products Division/3M

Building 220-7W, 3M Center
St. Paul, Minnesota 55144-1000

3M

3M
Organic Vapor Monitor
Analysis Guide

USE OF THE ANALYSIS GUIDE TABLES:

The Analysis Guide is designed for the customer involved in the analysis of the 3M #3500 Organic Vapor Monitor by the gas chromatograph. The following tables summarize the 3M monitor sampling rate, capacity, recovery coefficient and calculation constants. The analysis guide provides the necessary information to calculate the time-weighted-average concentration in parts per million (ppm) or milligrams per cubic meter (mg/m^3).

A. Monitor Sample Information

- **Sampling Rate**

The (*) compounds in the Sampling Guide tables have been subjected to an extensive amount of laboratory work to verify the sampling rate. The sampling rates given for the remaining compounds in this table were determined from empirical relationships as outlined in a publication on Sampling Rate Validation. All sampling rates have an accuracy of ± 5%. The sampling rates are tabulated as either cubic centimeters/minute or micrograms/ppm-hour.

- **Capacity**

The capacity of the monitor for each individual compound is a function of molecular structure, vapor pressure, environmental conditions, etc. The capacity is stated in terms of weight (milligrams). For a single contaminant, if the analyst finds the weight collected by the monitor is greater than the defined capacity, then the validity of the sample should be questioned.

When sampling multiple contaminants, the combined weights of the contaminants collected should not exceed the defined value for the single contaminant with the lowest capacity.

- **Recovery Coefficients (Desorption Efficiency)**

The collected sample is removed from the activated carbon wafer for analysis by desorption with carbon disulfide (CS_2) or other suitable solvents. In order for the laboratory analyst to determine accurately the amount of contaminant collected by the adsorbent, it is necessary to know the efficiency of the desorption process. The recovery coefficient or desorption efficiency is determined by adding a known weight of contaminant onto the adsorbent and measuring the weight of contaminant in the desorbing solvent. The recovery coefficient is calculated by dividing the recovered weight by the known weight. It is recommended that each analytical laboratory determine recovery coefficients according to the procedure outlined by the 3M laboratory contained in the Analysis Guide as "Recommended Procedure for Determination of Recovery Coefficients." Recovery coefficients determined by the 3M laboratory are tabulated in the following tables.

B. Procedure to Calculate Contaminant Concentrations

The time-weighted-average concentration of the environment sampled can be calculated by knowing the length of the sampling period, the contaminant weight determined by gas chromatography, the recovery coefficient and the calculation constant either A or B. The calculation constant A is used to calculate the concentration when expressed in units of milligrams per cubic meter (mg/m^3) and constant B when expressed in units of parts per million (ppm). The calculation constant A and B have been determined for every contaminant in the Analysis Guide by the following expressions:

$$A = \frac{1000}{\text{Sampling Rate}}$$

$$B = \frac{1000 \quad \times \quad (24.45)}{(\text{Sampling Rate}) \quad \times \quad (\text{Molecular Weight})}$$

The contaminant concentration can be calculated with the following information:

- **Sampling Information**

  Contaminant
  Length of Sampling Period (min.) **t**

- ***Contaminant Information from Tables in Analysis Guide***

  Calculation Constant **A** or **B**

- **Analytical Results**

  Contaminant weight recovered **W** (Micrograms)
  Recovery Coefficient **(r)**

The time-weighted-average concentration in milligrams per cubic meter of the contaminant in the environment sampled can be calculated from the following expression:

$$C(mg/m^3) = \frac{W\,(\text{micrograms})}{r \times t\,(\text{minutes})} \times A$$

The time-weighted-average concentration in parts per million (ppm) of the contaminant can be calculated from the following expression:

$$C(ppm) = \frac{W\,(\text{micrograms})}{r \times t\,(\text{minutes})} \times B$$

The above expressions calculate the time-weighted-average concentrations at a sampling temperature of 25°C (298°K) and pressure of 760 mm. When sampling at other environmental conditions, the above expressions need to be corrected only for variations in temperature. The above expressions can be multiplied by the following temperatures correction factors (CF_T) for samples collected at temperatures other than 25°C (77°F).

Sampling (°C)	Temperature (°F)	Temperature Correction Factor (CF_T)
44	111	.97
37	99	.98
31	88	.99
25	77	1.00
19	66	1.01
13	55	1.02
7	45	1.03
2	36	1.04
− 3	27	1.05
− 8	18	1.06

From the above table, every 10-11° above or below 77°F requires a one percent correction to the calculated time-weighted-average concentration.

If the temperature correction is desired, the time weighted average concentration can be calculated by the following expression:

$$C(mg/m^3) = \frac{W\,(\text{micrograms})}{r \times t\,(\text{minutes})} \times A \times \mathbf{CF_T}$$

$$C(ppm) = \frac{W\,(\text{micrograms})}{r \times t\,(\text{minutes})} \times B \times \mathbf{CF_T}$$

Example Calculation

Contaminant	Benzene
Length of Sampling Period (t)	420 minutes
Temperature (T)	75°F
Calculation Constant A	28.2
or	
B	8.83
Contaminant Weight Recovered (W)	27.2 micrograms
Recovery Coefficient(r)	1.02

Using Calculation Constant A:

$$C(mg/m^3) = \frac{27.2}{(1.02)\quad(420)} \times 28.2$$

$C = 1.79$ mg/m^3

Using Calculation Constant B:

$$C\,(ppm) = \frac{27.2}{(1.02)\quad(4.20)} \times 8.83$$

$C = .56$ ppm

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant	
				A (mg/m^3)	B (ppm)
Acetone*	40.1 ± .9	3	.87	24.9	10.51
Acetonitrile	48.2	14	—	20.8	12.37
Acrylonitrile	43.8	11	—	22.8	10.53
Allyl Alcohol	40.4	20	—	24.75	10.43
Allyl Chloride	35.1	1	—	28.5	9.05
n-Amyl Acetate*	26.0 ± .5	>25	1.08	38.6	7.26
s-Amyl Acetate	27.2	>25	—	36.8	6.91
n-Amyl Alcohol*	31.2 ± .4	>25	1.00+	32.1	8.91
i-Amyl Alcohol*	32.3 ± .4	>25	.99+	31.0	8.63
s-Amyl Alcohol	32.3	>25	.99+	31.0	8.60
Benzene*	35.5 ± .6	13	1.02	28.2	8.83
Benzyl Chloride	27.2	>25	1.05	36.8	7.08
Bromoform	29.3	>25	1.05	34.1	3.30
Butadiene	42.8	.4	—	23.4	10.53
n-Butyl Acetate	31.6	25	1.04	31.7	6.67
s-Butyl Acetate	28.6	>25	1.07	35.0	7.37
t-Butyl Acetate	29.4	19	1.05	34.0	7.17
Butyl Acrylate	28.7	>25	—	34.8	6.66
Butyl Alcohol*	34.3 ± .7	>25	.98+	29.2	9.63
s-Butyl Alcohol	34.8	19	.97+	28.7	9.44
t-Butyl Alcohol	35.2	13	—	28.4	9.39
Butyl Cellosolve* (2-Butoxyethanol)	28.2 ± .6	>25	.86	35.5	7.35
Butyl Glycidyl Ether (BGE)	27.0	>25	—	37.0	6.97
p-tert-Butyltoluene*	20.7 ± .4	>25	1.10	48.3	7.98
Camphor	21.4	>25	—	46.7	7.52
Carbon Disulfide	42.8	1	—	23.4	7.52
Carbon Tetrachloride*	30.2 ± .4	14	1.05	33.1	5.26
Cellosolve* (2-Ethoxyethanol)	32.4 ± .9	>25	.78	30.9	8.39
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	26.6 ± .4	>25	1.03	37.6	6.96
Chlorobenzene*	29.3 ± .6	>25	1.00	34.1	7.38
o-Chlorostyrene	26.0	>25	—	38.5	6.77
o-Chlorotoluene	27.3	>25	—	36.6	7.05
Chlorobromomethane*	34.4 ± .9	10	1.00	29.1	5.51
Chloroform	33.5	7	.98	29.9	6.13
1-Chloro-1-nitropropane	30.4	>25	—	32.9	6.49
Chloroprene (2-Chloro-1,3-butadiene)	32.2	5	—	31.1	8.53
Cumene*	24.5 ± .9	>25	.96	40.8	8.32
Cyclohexane*	32.4 ± .7	22	1.07	30.9	8.98
Cyclohexanol*	29.5 ± .3	>25	1.00+	32.7	8.48
Cyclohexanone*	28.9 ± .3	>25	.97	34.6	8.63
Cyclohexene*	32.3 ± .4	22	1.02	31.0	9.23
Diacetone Alcohol*	28.2 ± .4	>25	1.04+	35.5	7.47
o-Dichlorobenzene*	27.8 ± .6	>25	.95	36.0	5.98
p-Dichlorobenzene*	27.8 ± .6	>25	.95	36.0	5.98
1,1 Dichloroethane	33.2	4	—	30.1	7.44
1,2 Dichloroethylene*	35.2 ± .5	1	.99	28.4	7.16
1,1 Dichloro-1-nitroethane	28.5	>25	—	35.1	5.96
Dichloroethyl Ether	26.1	>25	—	38.3	6.55

+ Methylene Chloride as the solvent

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant A (mg/m^3)	Calculation Constant B (ppm)
Diisobutyl Ketone*	24.6 ± .8	>25	1.07	40.7	7.00
Dimethyl Formamide	32.4	>25	—	30.9	10.34
p-Dioxane	34.5	>25	—	29.0	8.05
Dipropylene Glycol Methyl Ether	25.3	>25	—	39.5	6.53
Enflurane (2-Chloro-1,1,2 trifluoro-ethyl difluoromethyl ether)	28.3	4	—	35.3	4.68
Epichlorohydrin (1-Chloro-2,3-epoxy-propane)	29.6	>25	.95	33.8	8.88
Ethyl Acetate*	34.5 ± .6	10	1.01	29.0	8.05
Ethyl Acrylate	32.2	19	—	31.1	7.59
Ethyl Alcohol	51.2	12	—	19.5	10.38
Ethyl Benzene	27.3	>25	—	36.6	8.45
Ethyl Bromide*	36.4 ± .3	1	1.03	27.5	6.16
Ethyl Butyl Ketone (3-Heptanone)	28.0	>25	—	35.7	7.66
Ethyl Ether	36.8	.4	—	27.2	8.98
Ethyl Formate	38.8	1	—	25.8	8.52
Ethylene Chlorohydrin (2-Chloroethanol)	33.9	>25	—	29.5	8.90
Ethylene Dibromide* (1,2-Dibromomethane)	29.6 ± .4	>25	1.04	33.8	4.39
Ethylene Dichloride* (1,2-Dichloroethane)	33.2 ± .7	18	1.02	30.1	7.44
Furfural	34.3	>25	—	32.8	8.35
Furfuryl Alcohol	32.6	>25	—	30.7	7.65
Glycidol (2,3-Epoxy-1-propanol)	37.1	>25	—	27.0	8.91
Halothane (2-Bromo-2-chloro-1,1,1 trifluoroethane)	30.2	4	—	33.1	5.96
Heptane*	28.9 ± .7	>25	1.08	34.6	8.46
Hexachloroethane	26.7	>25	—	37.5	3.86
Hexane*	32.0 ± .7	18	1.05	31.3	8.88
s-Hexyl Acetate	28.1	>25	—	35.6	6.04
Isoamyl Acetate	27.2	>25	—	36.8	8.64
Isoamyl Alcohol*	32.3 ± .4	>25	1.03+	31.0	8.60
Isobutyl Acetate*	31.0 ± .3	>25	—	32.3	6.80
Isobutyl Alcohol*	35.9 ± .7	>25	1.02+	27.9	9.20
Isophorone*	21.7 ± .7	>25	1.03+	46.1	8.16
Isopropyl Acetate	31.7	15	1.05+	31.5	7.56
Isopropyl Alcohol	39.4	17	—	25.4	10.34
Isopropyl Ether	31.2	10	—	33.0	7.91
Isopropyl Glycidyl Ether	29.1	>25	—	34.4	7.24
Mesityl Oxide*	31.2 ± 1.2	>25	.99	32.1	8.00
Mesitylene* (Trimethyl Benzene)	26.3 ± .7	>25	1.06	38.0	7.75
Methyl Acetate*	37.0 ± .6	2	1.00	27.0	8.93
Methyl Acrylate	35.8	11	—	27.9	7.94
Methylal (Dimethyoxymethane)	37.9	1	—	26.4	8.49
Methyl Amyl Ketone (2-Heptanone)	27.9	>25	—	35.8	7.69
Methyl Bromide	46.5	.5	—	21.5	5.53
Methyl Butyl Ketone* (2-Hexanone)	29.7 ± .7	>25	1.00	33.7	8.23
Methyl Isobutyl Ketone* (Hexanone)	30.0 ± .4	>25	1.06	33.3	8.15
Methyl Cellosolve* (2-Methoxyethanol)	36.3 ± .4	>25	.75	27.5	8.86

+ Methylene Chloride as the solvent

ANALYSIS GUIDE

	Sampling Rate (cc/min)	Capacity (mg)	Recovery Coefficient	Calculation Constant	
				A (mg/m^3)	B (ppm)
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	29.0 ± .5	>25	1.00	34.5	7.14
Methyl Chloroform*	30.9 ± .3	12	1.03	32.4	5.95
Methyl Cyclohexane*	28.9 ± .4	>25	1.05	34.6	8.63
Methyl Cyclohexanol	28.8	>25	—	34.7	7.45
Methyl Ethyl Ketone* (2-Butanone)	36.3 ± .9	12	1.00	27.5	9.35
Methyl Formate	45.0	.2	—	22.2	9.06
5-Methyl-3-heptanone (Ethyl Amyl Ketone)	26.4	>25	—	37.9	7.24
Methyl Iodide	36.7	.2	—	27.3	4.69
Methyl Isobutyl Carbinol (Methyl Amyl Alcohol)	29.2	>25	—	34.2	8.21
Methyl Isoamyl Ketone	28.0	>25	—	35.7	7.86
Methyl Methacrylate	31.8	24	—	31.5	7.69
Alpha Methyl Styrene*	25.0 ± .5	>25	1.01	40.0	8.29
Methylene Chloride* (Dichloromethane)	37.9 ± .3	2	.90	26.9	7.59
Naphtha (VM&P)*	33.2 ± .7	20	1.04	30.1	7.36
Naphthalene	24.6	>25	—	40.7	7.76
Nonane*	24.6 ± .6	>25	1.09	40.7	9.04
Octane*	26.6 ± .6	>25	1.08	37.6	8.06
Pentane*	35.3 ± .9	7	1.02	28.3	9.62
2-Pentanone* (Methyl Propyl Ketone)	33.0 ± .5	23	1.03	30.3	8.62
Perchloroethylene*	28.3 ± .5	>25	1.05	35.3	5.20
Phenyl Ether	24.1	>25	—	41.5	5.97
Phenyl Glycidyl Ether	20.8	>25	—	48.1	7.84
n-Propyl Acetate*	30.1 ± .5	21	-	33.3	7.96
n-Propyl Alcohol*	39.7 ± .7	25	.93+	25.2	10.26
Propylene Dichloride* (1,2 Dichloropropane)	30.6 ± .4	25	1.04	32.7	7.07
Propylene Glycol Monomethyl Ether	32.4	>25	—	32.3	7.58
n-Propyl Nitrate	33.3	>25	—	30.0	8.25
Stoddard Solvent	24.3	>25	—	41.2	6.99
Styrene*	26.8 ± .8	>25	1.08	37.3	8.77
1,1,2,2-Tetrachloroethane	28.4	>25	.89	35.2	5.12
1,1,1,2-Tetrachloro-2,2-difluoroethane	29.7	5	—	33.9	4.06
1,1,2,2-Tetrachloro-1,2-difluoroethane	28.2	5	—	35.5	4.25
Tetrahydrofuran	37.2	8	—	26.8	9.13
Toluene*	31.4 ± .6	25	1.05	31.8	8.46
1,1,2-Trichloroethane*	29.7 ± .6	>25	1.02	33.7	6.19
Trichloroethylene*	31.1 ± .2	20	1.00	32.2	6.00
1,1,2-Trichloro-1,2,2-trifluoroethane	31.4	.5	—	31.9	4.16
1,2,3-Trichloropropane	27.4	>25	—	36.5	6.07
Vinyl Acetate	35.8	7	1.02	27.9	7.94
Vinyl Bromide	41.0	.3	—	24.4	5.57
Vinyl Chloride*	40.8 ± .5	.04	1.02	24.4	9.56
Vinylidene Chloride	38.4	.5	—	25.9	6.53
Vinyl Toluene	26.8	>25	—	37.3	7.73
Xylene*	27.3 ± .5	>25	1.07	36.6	8.45

+ Methylene Chloride as the solvent

3M

ORGANIC VAPOR MONITOR #3520

SAMPLING GUIDE

#3520 Sampling Information

The Organic Vapor Monitor #3520 is a diffusional sampling device with a backup section. The monitor consists of two layers of adsorbent media separated by a small space containing a placid air layer. For a specific contaminant, the secondary adsorbent in the backup section collects contaminant when the capacity of the primary adsorbent has been exceeded. The diffusional sampling capacity for the primary adsorbent can be defined as the weight adsorbed when the weight collection rate is no longer a linear function of the exposure. Although the diffusional capacity for the primary adsorbent may be reached during sampling, the primary adsorbent will continue to collect contaminant even though the weight collection rate deviates from the linear relationship.

The weight (Wp) collected on the primary (top) adsorbent even though in excess of the defined diffusional capacity can be combined with the weight (ws) collected on the secondary (bottom) adsorbent to give an accurate determination of the time-weight-average concentration in the sampled environment. The sample valid: can be determined by comparing the ratio of the weight (Ws) collected by the secondary and the weight (Wp) collected by the primary adsorbent. The ratio Ws/Wp must be equal to or less than 0.50.

A. Sampling Rate

The top section of the #3520 containing the primary adsorbent has the same geometric dimension as the 3M Organic Vapor Monitor #3500 and therefore the sampling rates are the same as those tabulated in the Sampling Guide for the Organic Vapor Monitor #3500 (coded R-355 The sampling rates for the Organic Vapor Monitor #3520 also have an accuracy of ±5%.

B. Capacity

Because of the backup section, the effective sampling capacity of the Organic Vapor Monitor #3520 is greater by a factor of four over those tabulated in the Analysis Guide for the Organic Vapor Monitor #3500. (code R-35AG)

When sampling environments containing contaminant mixture of environment with high relative humidity, it is difficult to accurately define the deffusional sampling capacity. Therefore, under these conditions, the weight (Ws) collected by the secondary adsorbent of the backup section can be compared with the weight (W collected by the primary adsorbent to determine sample validity.

When sampling mixtures, the weight ratio Ws/Wp can be determined for each contaminant. The sample is valid for each contaminant wh[illegible] ratio is equal to or less than 0.50.

C. Length of Sampling Period

When sampling for Organic contaminants, full workshift sampling periods are recommended as the most comprehensive measure of worker exposure. When using the Organic Vapor Monitor #3520, the sampling guide for the Organic Vapor Monitor #3500 should be consulted. For those compounds where the recommended length of the sampling period for the Organic Vapor Monitor #3500 is less than a full workshift, the length of the sampling period can be increased by a factor of four when using the Organic Vapor Monitor #3520 because it has four times more effective contaminant capacity. Because of this increased effective capacity of the Organic Vapor Monitor #3520, samplin[illegible] periods longer than a full workshift are possible, but the preferred recommendation is for full workshift sampling periods.

In the sampling guide for the Organic Vapor Monitor #3500, there are a number of compounds where even at relative humidities < 70%, sampling was not recommended (NR) at high concentrations with the Organic Vapor Monitor #3500. Now with the Organic Vapor Monitor #3520, these compounds can be sampled. The following sampling guide for the Organic Vapor Monitor #3520 gives the recommended sampling period for these compounds.

COMPOUND	RECOMMENDED SAMPLING PERIOD (hrs.)			
	RH < 70%		RH > 70%	
	.1-.5 PEL	.5-3 PEL	.1-.5 PEL	.5-3 PEL
Butadiene	1.6	.3	1.6	.3
Ethyl Ether	1.2	.2	1.2	.2
Methylal (Dimethoxymethane)	1.2	.2	1.2	.2
Methyl Formate	2.8	.5	2.8	.5
1,1,2 Trichloro 1,2,2 trifluoroethane	2.0	.4	2.0	.4

3M Organic Vapor Monitor Selection Chart

Sampling Parameters	Monitor Recommendation #3500	#3520
Relative Humidity		
High (>70%)	x[1]	x
Low (<70%)	x	x
Short Term Exposures		
STELS	x[2]	
High Vapor Pressure Compounds		
Including: acrylonitrile, pentane, vinyl chloride, acetone, methylene chloride, butadiene, ethanol		x[3]
Contaminant Concentrations		
High (over 3x PEL)		x
Moderate[4] (.5-3x PEL)	x	x
Low[4] (up to .5 PEL)	x	x
Unknown		x

1 Refer to #3500 Sampling Guide (R-35SG) for maximum time for use at high humidity

2 Refer to #3500 Sampling Guide (R-35SG) for those compounds best suited for STEL

3 See reverse side for the specific sampling recommendations for these compounds

4 Refer to Sampling Guide (R-35SG) for specific compound recommendations

R-3520 SG

3M
Organic Vapor Monitor
Sampling Guide
For
Organic Vapor Monitor #3500/3510
Organic Vapor Monitor
With Back-Up Section #3520

December, 1982

ANOTHER STEP TOWARDS BETTER OCCUPATIONAL HEALTH AND SAFETY

70-0701-1274-6(75.25)R1

Litho in U.S.A.

Occupational Health and Safety Products Division/3M
220-7W 3M Center
St. Paul, Minnesota 55144

Use of the Sampling Guide Tables:

The following table summarizes OSHA standards, 3M monitor sampling information and recommended sampling procedures for a variety of organic compounds for which the 3M Organic Vapor Monitors can be used to acccurately determine the environmental exposures. The table is not exhaustive and will be updated periodically. To obtain periodic updates, return the registration card contained in every box of monitors to 3M Company.

A. OSHA Standards

The OSHA TWA-PEL's (Time Weighted Average) given as workshift time weighted averages are taken from the Federal Register as found in 29 CRF 1910.1000 as of 1 January 1977 and are summarized in the "NIOSH/OSHA Pocket Guide to Chemical Hazards." Also included in parentheses are the current ACGIH (American Conference of Governmental Industrial Hygienist) values in cases where they differ from OSHA TWA's. These values are subject to change and appropriate publications should be consulted for the most current information.

B. Monitor Samples Information

* Sampling Rate

All sampling rates have an accuracy of ± 5%. The (*) compounds in the Sampling Guide tables have been subjected to an extensive amount of laboratory work to verify the sampling rate. The sampling rates given for the remaining compounds in this table were determined from empirical relationships as outlines in a publication on Sampling Rate Validation. The sampling rates are tabulated as cubic centimeters/minute and micrograms/ppm-hour. The publication on Sampling Rate Validation Protocol can be obtained upon request from 3M Company.

The top section of the #3520 (containing the primary absorbent) has the same geometric dimension as the 3M Organic Vapor Monitor #3500. Therefore, the sampling rates are the same, and also have an accuracy of ±5%.

* Capacity

The capacity of the monitor for each individual compound is a function of molecular structure, vapor pressure, environmental conditions, etc. The capacity values are tabulated in Section II - Analysis Guide, and are used to determine the length of a recommended sampling period.

Because of the backup section, the effective sampling capacity of the Organic Vapor Monitor #3520 is four times greater than the values listed for the Organic Vapor Monitor #3500/3510.

When sampling environments containing contaminant mixtures on environments with high relative humidity, it is difficult to accurately define the diffusional sampling capacity. Therefore, under these conditions, the weight (Ws) collected by the secondary absorbent of the backup section can be compared with the weight (Wp) collected by the primary absorbent to determine sample validity. The ration Ws/Wp must be equal to or less than 0.50.

C. Length of Sampling Period

1. General

3500/3510

When sampling for organic contaminants, full workshift sampling periods are recommended as the most comprehensive measures of worker exposure. When sampling some organic contaminants, sampling periods shorter than a full workshift are required in order to sample within the recommended capacity of the monitor. Under these circumstances, sequential sampling with several monitors can be performed.

3520

For those compounds where the recommended length of the sampling period for the Organic Vapor Monitor 3500/3510 is less than a full workshift, the length of the sampling period can be increased by a factor of four when using the Organic Vapor Monitor #3520. Because of the increased effective capacity of the Organic Vapor Monitor #3520, sampling periods longer than a full workshift are possible. **The preferred recommendation is for full workshift sampling periods.**

2. **Effect on Humidity**

Recommended sampling periods have been tabulated for concentration ranges from .1 to .5 times the PEL and from .5 to 3 times the PEL for relative humidities less than or greater than 70%. These recommended sampling periods should not be exceeded when using OVM #3500/3510.

3. **Minimum Sampling Time**

To confirm quantitatively the presence and concentration of a contaminant in the atmosphere, most analysts must have a minimum of 10 micrograms for G.C. analysis. A sampling period of at least 15 minutes is recommended even when 10 micrograms of the contaminant could be collected in a shorter period. For a contaminant at a low concentration level, the sampling rate of micrograms/ppm-hr. should be used to verify a sampling period during which at least 10 micrograms of the contaminant would be collected.

D. Short Term Exposure Limit (STEL)

The ACGIH has recommended a short-term exposure limit (STEL) as a maximum concentration to which workers can be exposed for a period up to 15 minutes continuously. No more than four (4) such excursions per day are permitted, with at least 60 minutes between exposure periods, provided that the recommended ACGIH daily TLV-TWA also is not exceeded. The STEL values summarized in the following tables can be found in the "Threshold Limit Values for Chemical Substances in Workroom Air Adopted by ACGIH for 1980." The monitor is recommended for STEL sampling if, during the 15 minute sampling period, the monitor will collect a minimum of 10 micorgrams of the contaminant when sampling at the STEL concentrations.

E. Unsuitable Compounds

The OVM is not recommended for the compounds listed below because of adverse or inadequate interactions with the sorbent material. This list is representative of classes of compounds not suitable for use with the OVM.

Compounds not on this list or the Compound Guide should be handled by consultation with OH&SP Technical Service.

Compounds

Ammonia	Methane, Ethane, Propane
Carbon Monixide (1)	Methyl Alcohol (Methanol)
Ethylene Oxide (2)	Methyl Chloride
Formaldehyde (3)	Methyl; Dimethyl, Trimethyl Amines
Hydrogen Sulfide	Organic Solids
Isocyanates	Sulfur Dioxide

(1) Carbon Monixide can be monitored using 3M Monitor #3400
(2) Ethylene Oxide can be monitored using 3M Ethylene Oxide Monitor #3550/3551
* (3) Formaldehyde can be monitored using 3M Formaldehyde Monitor #3750/3751

F. Compounds Printed in Bold Type

All compounds listed in **bold** type in the OVM Sampling Guide will be analyzed by 3M for the OVM #3510. †For more information contact your 3M Sales Representative or your local OH&SP Safety Products Distributor.

†Pre-paid analysis for up to three compounds.

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.) RH < 70% .1-.5 PEL	RH < 70% .5-3 PEL	RH > 70% .1-.5 PEL	RH > 70% .5-3 PEL	SHORT TERM EXPOSURE LIMIT (15 min.) STEL (ppm)	OVM Usage	OSHA Standard TWA-PEL ( ) ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE (cc/min.)	Microgram ppm/hr.
/Acetone*	1	0.5	1	0.5	1250	Yes	1000	40.1	5.71
Acetonitrile*	8	2	6	1	60	Yes	40	48.2	4.85
Acrylonitrile	8	2	6	1	—		2	43.8	5.70
Allyl Alcohol	8	8	8	6	2	No	2	40.4	5.75
Allyl Chloride	8	8	8	6	2	No	1	35.1	6.63
n-Amyl Acetate*	8	8	8	4	150	Yes	100	26.0	7.38
s-Amyl Acetate	8	8	8	4	—		125	27.2	8.68
n-Amyl Alcohol*	8	8	8	4	—		(100)	31.4	6.78
i-Amyl Alcohol*	8	8	8	4	125	Yes	100	32.3	6.98
s-Amyl Alcohol	8	8	8	4	—		(100)	32.3	6.98
Benzene*	8	8	8	6	25	Yes	10	35.5	6.78
Benzyl Chloride	8	8	8	6	—		1	27.2	8.48
Bromoform	8	8	8	6	—		0.5	29.3	18.19
Butadiene	0.4	NR	0.4	NR	1250	Yes	1000	42.8	5.67
n-Butyl Acetate	8	7	6	3	200	Yes	150	31.6	9.00
s-Butyl Acetate	8	5	6	3	250	Yes	200	28.6	8.14
t-Butyl Acetate	8	4	6	3	250	Yes	200	29.4	8.37
Butyl Acrylate	8	8	8	6	—		— (10)	28.7	9.01
Butyl Alcohol*	8	8	8	4	—		100 (50)	34.3	5.55
s-Butyl Alcohol	8	6	6	3	—		150	34.8	6.32
t-Butyl Alcohol	8	7	6	3	150	Yes	100	35.2	6.39
Butyl Cellosolve* (2-Butoxyethanol)	8	8	8	6	150	Yes	50	28.2	8.15
Butyl Glycidyl Ether (BGE)	8	8	8	6	—		50	27.0	8.61
p-tert-Butyltoluene*	8	8	8	6	20	Yes	10	20.7	7.51
Camphor	8	8	8	6	3	No	2	21.4	7.11
Carbon Disulfide	8	2	6	1	—		20	42.8	7.88
Carbon Tetrachloride*	8	8	8	6	20	Yes	10	30.2	11.41
Cellosolve* (2-Ethoxyethanol)	8	5	8	3	150	Yes	200 (100)	32.4	7.14
Cellosolve Acetate* (2-Ethoxyethyl Acetate)	8	8	8	4	150	Yes	100	26.6	8.60
Chlorobenzene*	8	8	8	5	—		75	29.3	8.12
o-Chlorostyrene	8	8	8	6	75	Yes	— (50)	26.0	8.87
o-Chlorotoluene	8	8	8	6	75	Yes	— (50)	27.3	8.51
Chlorobromomethane*	8	1.5	6	1.5	250	Yes	200	34.4	10.89
Chloroform*	8	4	6	3	50	Yes	50 (10)	33.5	9.78
1-Chloro-1-nitropropane	8	8	8	6	—		20	30.4	9.25
Chloroprene (2-Chloro-1,3-butadiene)	8	8	6	4	—		25 (10)	32.2	7.03
Cumene*	8	8	8	6	75	Yes	50	24.5	8.82
Cyclohexane*	8	3	6	2	375	Yes	300	32.4	6.67
Cyclohexanol*	8	8	8	6	—		50	29.5	7.24
Cyclohexanone*	8	8	8	6	—		50	28.9	6.94
Cyclohexene*	8	3	6	2	—		300	32.3	6.49
Diacetone Alcohol*	8	8	8	6	75	Yes	50	28.2	7.15
o-Dichlorobenzene*	8	8	8	6	—		50	27.8	10.03
p-Dichlorobenzene*	8	8	8	6	110	Yes	75	27.8	10.03
1,1-Dichloroethane	8	1.5	4	1.5	250	Yes	100 (200)	33.2	8.07
1,2-Dichloroethylene*	1	0.2	1	0.2	250	Yes	200	35.2	8.38
1,1-Dichloro-1-nitroethane	8	8	8	6	10	Yes	10	28.5	10.07
Dichloroethyl Ether	8	8	8	6	10	Yes	15 (5)	26.1	9.16
Diisobutyl Ketone* (DIBK)	8	8	8	6	—		50	24.6	8.56

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.) RH < 70% .1-.5 PEL	RH < 70% .5-3 PEL	RH > 70% .1-.5 PEL	RH > 70% .5-3 PEL	SHORT TERM EXPOSURE LIMIT (15 min.) STEL (ppm)	OVM Usage	OSHA Standard TWA-PEL ( ) ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE (cc/min.)	Microgram ppm/hr.
Dimethyl Formamide (DMF)	8	8	8	6	20	Yes	10	32.4	5.8
p-Dioxane	8	8	8	4	—		100 (50)	34.5	7.45
Dipropylene Glycol Methyl Ether	8	8	8	4	150	Yes	100	25.3	9.19
Enflurane (2-Chloro-1,1,2 trifluoroethyl difluoromethyl ether)	8	8	8	6	—		— (2)	28.3	12.81
Epichlorohydrin (1-Chloro-2,3-epoxy-propane)	8	8	8	6	5	No	5 (2)	29.6	6.76
Ethyl Acetate*	7	1	4	1	—		400	34.5	7.45
Ethyl Acrylate	8	8	6	4	—		25	32.2	7.90
Ethyl Alcohol	4	0.5	4	0.5	—		1000	51.2	5.78
Ethyl Benzene	8	8	8	4	125	Yes	100	27.3	7.10
Ethyl Bromide*	1	0.2	1	0.2	250	Yes	200	36.4	9.74
Ethyl Butyl Ketone (3-Heptanone)	8	8	8	6	75	Yes	50	28.0	7.83
Ethyl Ether	0.3	NR	0.3	NR	500	Yes	400	36.8	6.68
Ethyl Formate	3	0.5	3	0.5	150	Yes	100	38.8	7.04
Ethylene Chlorohydrin (2-Chloroethanol)	8	8	8	6	—		5	33.9	6.66
Ethylene Dibromide* (1,2-Dibromomethane)	8	8	8	6	—		20	29.6	13.66
Ethylene Dichloride* (1,2-Dichloroethane)	8	8	6	4	15	Yes	50 (10)	33.2	8.07
Furfural	8	8	8	8	15	Yes	5	34.3	8.08
Furfuryl Alcohol	8	8	8	6	10	Yes	50 (5)	32.6	6.98
Glycidol (2,3-Epoxy-1-propanol)	8	8	8	6	75	Yes	50	37.1	6.74
Halothane (2-Bromo-2-chloro-1,1,1 trifluoroethane)	8	8	6	4	—		— (2)	30.2	14.63
Heptane*	8	2	4	2	500	Yes	500 (400)	28.9	7.08
Hexachloroethane	8	8	8	8	3	Yes	1	26.7	15.53
Hexane*	8	1.5	4	1.5	125	Yes	500 (100)	32.0	6.74
s-Hexyl Acetate	8	8	8	4	—		50	28.1	9.93
Isoamyl Acetate	8	8	8	4	125	Yes	100	27.2	8.68
Isoamyl Alcohol*	8	8	8	4	125	Yes	100	32.3	6.98
Isobutyl Acetate*	8	8	8	4	187	Yes	150	31.0	8.82
Isobutyl Alcohol*	8	8	8	4	75	Yes	100 (50)	35.9	5.81
Isophorone*	8	8	8	6	—		25 (5)	21.7	7.34
Isopropyl Acetate	8	2	6	2	310	Yes	250	31.7	7.93
Isopropyl Alcohol	8	2	6	2	500	Yes	400 (250)	39.4	5.17
Isopropyl Ether	5	0.8	4	0.8	310	Yes	500 (250)	31.2	7.81
Isopropyl Glycidyl Ether	8	8	8	6	75	Yes	50	29.1	8.28
Mesityl Oxide*	8	8	8	6	—		25	31.2	7.49
Mesitylene* (Trimethyl Benzene)	8	8	8	6	35	Yes	25	26.3	7.73
Methyl Acetate*	3	0.5	3	0.5	250	Yes	200	37.9	6.72
Methyl Acrylate	8	7	6	3	—		10	35.8	7.56
Methylal (Dimethyoxymethane)	0.3	NR	0.3	NR	1250	Yes	1000	37.9	7.07
Methyl Amyl Ketone (2-Heptanone)	8	8	8	4	150	Yes	100	27.9	7.81
Methyl Bromide	4	0.5	3	0.5	—		20 (15)	46.5	10.84

Sampling Guide

COMPOUND	RECOMMENDED SAMPLING PERIOD (Hrs.) RH < 70% .1-.5 PEL	RH < 70% .5-3 PEL	RH > 70% .1-.5 PEL	RH > 70% .5-3 PEL	SHORT TERM EXPOSURE LIMIT (15 min.) STEL (ppm)	OVM Usage	OSHA Standard TWA-PEL ( ) ACGIH TLV C-Ceiling (ppm)	SAMPLING RATE (cc/min.)	Microgram ppm/hr.
Methyl Butyl Ketone* (2-Hexanone)	8	8	8	4	50	Yes	100	29.7	7.29
Methyl Isobutyl Ketone* (Hexanone)	8	8	8	4	125	Yes	100	30.0	7.35
Methyl Cellosolve* (2-Methoxyethanol)	8	8	8	6	35	Yes	25	36.3	6.76
Methyl Cellosolve Acetate* (Ethylene Glycol Methyl Ether Acetate)	8	8	8	6	35	Yes	25	29.0	8.38
Methyl Chloroform*	6	1	4	1	450	Yes	350	30.9	10.09
Methyl Cyclohexane*	8	2.5	6	2	500	Yes	500	28.9	6.94
Methyl Cyclohexanol	8	8	8	4	75	Yes	100 (50)	28.8	8.06
Methyl Ethyl Ketone* (2-Butanone)	8	3	6	2	300	Yes	200	38.3	6.41
Methyl Formate	0.7	NR	0.7	NR	150	Yes	100	45.0	6.33
5-Methyl-3-heptanone (Ethyl Amyl Ketone)	8	8	8	6	—		25	26.4	7.39
Methyl Iodide	6	1	4	1	10	Yes	5	36.7	12.79
Myethyl Isobutyl Carbinol (Methyl Amyl Alcohol)	8	8	8	6	40	Yes	25	29.2	6.51
Methyl Isoamyl Ketone	8	8	8	4	150	Yes	100	28.0	7.83
Methyl Methacrylate	8	8	8	4	125	Yes	100	31.8	7.80
Alpha Methyl Styrene*	8	8	8	4	—		100	25.0	7.24
Methylene Chloride* (Dichloromethane)	1	0.2	1	0.2	250	Yes	500 (200)	37.9	7.91
Naphtha (VM&P)*	8	2	6	2	400	Yes	300	33.2	8.15
Naphthalene	8	8	8	6	15	Yes	10	24.6	6.88
Nonane*	8	5	6	3	250	Yes	— (200)	24.6	7.71
Octane*	8	3	6	2	375	Yes	500	26.6	7.43
Pentane*	2.5	0.4	2.5	0.4	750	Yes	1000 (600)	35.3	5.56
2-Pentanone* (Methyl Propyl Ketone)	8	5	6	3	250	Yes	200	33.0	6.95
Perchloroethylene (Tetrachloroethylene)	8	7	6	3	150	Yes	100	28.3	11.53
Phenyl Ether	8	8	8	6	2	No	1	24.1	10.05
Phenyl Glycidyl Ether	8	8	8	6	15	Yes	10	20.8	7.71
n-Propyl Acetate*	8	4	8	3	250	Yes	200	30.1	7.53
n-Propyl Alcohol*	8	8	6	4	250	Yes	200	39.7	5.21
Propylene Dichloride* (1,2-Dichloropropane)	8	8	6	4	110	Yes	75	30.6	8.49
Propylene Glycol Monomethyl Ether	8	8	8	4	150	Yes	— (100)	32.4	6.09
n-Propyl Nitrate	8	8	8	4	40	Yes	25	33.3	7.27
Stoddard Solvent	8	4	6	3	125	Yes	500 (100)	24.3	8.59
Styrene*	8	8	8	4	125	Yes	100	26.8	6.83
1,1,2,2-Tetrachloroethane	8	8	8	6	10	Yes	5	28.4	11.71
1,1,1,2-Tetrachloro-2,2-difluoroethane	5	0.75	4	0.75	625	Yes	500	29.7	14.87
1,1,2,2-Tetrachloro-1,2-difluoroethane	5	0.75	4	0.75	625	Yes	500	28.2	14.12
Tetrahydrofuran	8	2	4	2	250	Yes	200	37.2	6.57
Toluene*	8	6	6	3	150	Yes	200	31.4	7.08
1,1,2-Trichloroethane*	8	8	6	6	20	Yes	10	29.7	9.69
Trichloroethylene*	8	8	8	6	150	Yes	100 (50)	31.1	10.00
1,1,2-Trichloro-1,2,2-trifluoroethane	0.5	NR	0.5	NR	1250	Yes	1000	31.4	14.41
1,2,3-Trichloropropane	8	8	8	6	75	Yes	50	27.4	9.88
Vinyl Acetate	8	8	6	4	20	Yes	— (10)	35.8	7.56
Vinyl Bromide	2	2	2	2	—		(5)	41.0	10.77
Vinyl Chloride*	2	2	2	1.5	—		1 (5)	40.9	6.22
Vinylidene Chloride	2	2	2	2	20	Yes	(10)	38.6	9.19
Vinyl Toluene	8	8	6	4	150	Yes	100	26.8	7.75
Xylene*	8	8	6	4	150	Yes	100	27.3	7.09

ORGANIC VAPOR MONITOR #3520
WITH BACKUP SECTION

FACT SHEET

How do I know when to use the 3520 instead of the 3500?

The 3520 should be used when any of the following is expected:

a) Compounds to be monitored have boiling points of 60°C or less and/or high TLV's, (for example, methylene chloride, vinyl chloride, pentane).
b) Mixtures of compounds, some of which have boiling points of 60° or less, in high concentrations, (for example, acetone).
c) High concentrations of complex mixtures.

Please refer to the 3520 Sampling Guide for details.

Why are there additional parts for the 3520?

The 3520 is actually made up of two 3500's, one stacked atop the other. The additional parts are needed to seal both sections when sampling is finished. For the Top Section there is a closure cap exactly like the closure cap of the back-up section. In addition, there is a closure cap (the brown cap) for the bottom of the front section.

Can the 3520 be used for all the same applications as the 3500?

Yes, and more (see 3520 Sampling Guide).

Is the analysis any different with the 3520?

No, except that both the front and back sections are analyzed and their weights combined to determine the total exposure.

How do I know if the 3520 has been overexposed?

If the ratio of the weight of sample collected on the secondary adsorbent (W_s), to the weight collected on the primary adsorbent (W_p) is less that or equal to .5 then the sample is valid. Conversely, if the ratio exceeds .5 the 3520 has been overexposed.

$$\text{To be valid} \quad \frac{W_s}{W_p} \leq .50$$

Are the sampling rates any different for the 3520?

No, the sampling rate for the 3520 front section is the same as the sampling rate of the 3500. The backup section merely receives the overload.

How accurate is the 3520?

As accurate as the 3500. The sampling rates are verified to within ± 5% and all other parameters are the same for both.

What are the applications where 3520 should be used?

The 3520 should be used in any situation in which the concentrations of contaminants are unknown and expected to be high. In addition, when high concentrations of rather volatile compounds (vinyl chloride acrylonitrile, methylene chloride, etc.) are expected, when mixtures are sampled in which displacement from the sorbent in anticipated, or when mixtures are sampled in which one or more components are expected in high concentrations.

Can the 3520 be used as an area sampler?

Yes, just as the 3500 can be used.

How sensitive is the 3520?

As sensitive as the 3500. 3M recommends that at least 10 micrograms be collected in order to insure reliable results.

Is the 3520 affected by temperature or pressure changes any differently than the 3500?

No, it is not. There are no significant effects of atmospheric pressure changes on the performance of the 3500 or 3520. Effects of temperature changes can be calculated according to the procedure outlined in the 3M 3500 Analysis Guide which applies to the 3520 also.

3M #3520
ORGANIC VAPOR MONITOR WITH BACKUP SECTION
PRODUCT INFORMATION &
USAGE GUIDE

I. GENERAL DESCRIPTION

The 3M #3520 Organic Vapor Monitor with backup section is a badge to be worn near the breathing zone of personnel exposed to potential hazardous organic vapor environments. It is designed to measure time-weighted-average concentrations (which can be compared to the permissible exposure levels) over a measure time interval. The monitor is equipped with a backup section which collects contaminant when the capacity of the primary adsorbent has been exceeded. The monitor requires no sampling pump. It is analyzed using techniques similar to those outlined in NIOSH Method Physical and Chemical Analytical Method 127 for charcoal tubes. Analytical assay is correlated to environmental contaminant concentrations using data supplied by 3M Company.

II. PRINCIPLE OF THE METHOD

A. The contaminant enters the monitor by diffusion. The monitor consists of two layers of adsorbent medium separated by a small space within the monitor. The contaminant first diffuses to the primary adsorbent medium. The amount of contaminant adsorbed by the primary layer is determined by exposure time and contaminant concentration in the sampled environment. For a specific contaminant, the secondary adsorbent begins to collect contaminant by diffusion when the capacity of the primary adsorbent is exceeded.

B. At the end of the sampling period, the primary and secondary adsorbent sections of the monitor are separated and sealed with closure caps. For analysis, a measured volume of eluent is added to each section of the monitor to desorb the contaminants from the adsorbents.

C. For each section, an aliquot of the eluent solution is analyzed via gas chromatography. The weight of contaminant on each adsorptive medium is quantified by peak area comparison to known standards.

D. By comparing the weight collected on each of the adsorbents (secondary and primary), the validity of the sample collected by the monitor can be determined. The sample is valid if no contaminant is found on the secondary adsorbent or if the ratio of the weight collected on the secondary to the weight collected on the primary is less than or equal to .50. (See Section III. B.6 for details.)

E. If the sample is determined to be valid, then the weight of contaminant on the primary and secondary adsorbent is used to calculate the time-weighted-average concentration of the contaminant in the environment during the sampling period.

III. USE INSTRUCTIONS

A. Hygienist

1. The monitor is packaged to prevent contamination during shipment and handling. The monitor which is sealed in the clear inner bag must be removed from the zip lock package. The closure caps should remain in the zip lock package. The monitor should not be removed from the clear inner bag until just prior to use.

2. The monitor is removed from the clear inner package and the sampling start time is recorded on the back of the monitor. The monitor is attached near the breathing zone of the worker. The white side of the monitor must face outward. The white film and ring must not be removed until the sampling period is terminated.

3. The 3520 Organic Vapor Monitor with the backup section increases the effective sampling capacity by a factor of four over the 3500 Organic Vapor Monitor. Therefore, the recommended sampling periods tabulated in the Sampling Guide for the 3500 Organic Vapor Monitor can be increased four times when sampling with the 3520 Organic Vapor Monitor.

4. At the conclusion of the sampling period, the monitor is removed from the worker. The time at the end of the sampling period is recorded on the back of the monitor.

5. The white face and its retaining ring should immediately be removed with a coin or other suitable device. The closure cap is then immediately snapped on which terminates the sampling. The two ports in the cap are firmly closed with the attached plugs.

6. To insure proper operation of the secondary section, immediately separate the primary and secondary sections. The brown cup is snapped into place on the bottom of the primary section. The other closure cap is snapped on the secondary section. The two ports in the cap are firmly closed with the attached plugs. The importance of these steps should be emphasized, since environmental sampling continues until the bottom brown cup and closure caps are on with their ports closed.

7. The following information must be recorded on the package:

   a. Monitor number
   b. Date of exposure
   c. Employee I.D.
   d. Contaminant vapor(s) in the environment
   e. Temperature and relative humidity of the monitored environment if considered extreme
   f. Any comments or unusual circumstances

8. The capped monitor sections are snapped together back-to-back and placed into the appropriate original bag. The zip lock bag is then sealed.

9. A control or blank sample should be provided for the analyst. This is necessary for accuracy of results. The blank sample is prepared at the monitoring site using the following procedure:

   a. The monitor and closure caps are removed from the package.
   b. The white face and retaining ring are removed.
   c. The closure cap is snapped on and the ports closed.
   d. The primary and secondary sections are separated.
   e. The brown cup is installed on the bottom of the primary section. The second closure cap is snapped on the secondary sections and the ports closed.
   f. The package is labeled "blank" and the badge number for which it serves as a blank is recorded.
   g. The blank sample is packaged and submitted for analysis along with the exposed monitors.

10. The monitor should be analyzed as soon after use as possible using analytical techniques described in the "3M Brand Organic Vapor Monitor Compound Guide."

B. Analyst

1. Upon receipt of the exposed monitors, the analytical chemist should verify that:

   a. The closure caps are in place
   b. The ports of the closure caps are plugged
   c. The required information is recorded on the package

   Any deviations must be noted on the analytical report.

2. The center port is opened and 1.5 ml* of carbon disulfide is injected.

3. The elution step requires approximately one-half hour, with occasional gentle agitation.

4. Both closure cap ports are opened. The eluent solution is carefully decanted through the rim port into the automatic sampler vials for the gas chromatograph**. The vials are immediately sealed. If an automatic sampler is not being used, the aliquot for injection can be removed directly from the monitor through the center port on the cap.

5. Gas chromatographic analysis is conducted as outlined in NIOSH P&CAM 127. The corrected weight of each contaminant on the adsorptive element is obtained by subtracting out the contribution of the blank sample and dividing by the desorption efficiency determined for the contaminant.

6. The validity of the samples collected can be determined by comparing the weight (W_s) collected on the secondary adsorbent with the weight (W_p) collected on the primary adsorbent. Because the mass of activated carbon in the primary adsorbent is equivalent to the mass in the secondary adsorbent, the capacity of a contaminant on each should be equivalent. But, in order to assure a valid sample under all sampling conditions, the ratio of the contaminant weight (W_s) on the secondary adsorbent to the contaminant weight (W_p) on the primary adsorbent must meet the following criteria:

$$\frac{W_s}{W_p} \leq .50$$

When sampling the environment with multiple contaminants with the 3520 Organic Vapor Monitor, the above criteria can be used to determine the sample validity of each contaminant. Therefore, for those contaminants which fulfill the above criteria, the weight (W_p) on the primary adsorbent and the weight (W_s) on the secondary adsorbent can be used to accurately determine the time-weighted-average concentration.

7. The corrected weight of each contaminant on the primary and secondary adsorbent can be used to calculate the time-weighted-average concentration according to the following equation:

$$C(mg/m^3) = \frac{W_p}{K_p \times t} \quad \frac{W_s}{K_s \times t}$$

where,

W_p = corrected weight collected by the primary adsorbent
W_s = corrected weight collected by the secondary adsorbent
K_p = sampling rate of the contaminant onto the primary adsorbent
K_s = sampling rate of the contaminant onto the secondary adsorbent
t = length of sampling period

The above equation can be simplified to the following:

$$C(mg/m^3) = \frac{W_p + kW_s}{K_p \times t}$$

where,

k = 2.2 - a constant determined by the ratio of K_p/K_s. For all contaminants, this ratio has been determined to be a constant of 2.2.

With this simplication, the time-weighted-average concentration of the contaminant in the environment can be calculated from the corrected weight collected by the primary and secondary adsorbent, the length of the sampling period and the sampling rate. The geometric dimensions (area and length) of the primary diffusional chamber for the 3520 Organic Vapor Monitor with the backup section are the same as the dimensions of the diffusional chamber for the 3500 Organic Vapor Monitor. Therefore, the sampling rates (K_p) of the contaminants onto the primary adsorbent of the 3520 Organic Vapor Monitor are the same as those tabulated in the Sampling and Analysis Guide for the 3500 Organic Vapor Monitor in the 3M Brand Organic Vapor Monitor Compound Guide.

8. From the Analysis Guide, the Calculation Constants A and B can be used to further simplify the calculation of the time-weighted-average concentration. The concentration in milligrams per cubic meter of the contaminant in the environment sampled can be calculated from the following expression:***

$$C(mg/m^3) = \frac{W_p + 2.2\ W_s}{r \times t} \times A$$

The time-weighted-average concentration in parts per million (ppm) of the contaminant can be calculated from the following expression:

$$C(ppm) = \frac{W_p + 2.2\ W_s}{r \times t} \times B$$

9. The sampling rate (K_p) and the calculation constants A & B for each organic compound are obtained from 3M Brand Organic Vapor Monitor Compound Guide.

*The 1.5 ml eluent volume is appropriate for 2.0 ml automatic sampler vials. Different eluent volume may be used if desired, but corresponding desorption efficiency values must be verified.

**Decantation of the eluent solution into vials requires some technique to avoid spillage. It is recommended that this step be practiced a few times before valuable samples are attempted. A decanting spout extension is provided to facilitate transfer.

***The contaminant weights (W_p and W_s) in the following expressions are uncorrected for desorption efficiencies. The correction is made in the expressions by dividing by the desorption efficiency (r).

3M COMPANY

OCCUPATIONAL HEALTH & SAFETY PRODUCTS LABORATORY

Organic Vapor Analytical Method No. 2, Revision B
January, 1986

DETERMINATION OF SELECTED ORGANIC VAPORS IN AIR

SCOPE

This is a procedure which covers the method of analyzing samples to determine the amount of a particular organic vapor(s) present in the air. This procedure is to be used for those organic vapors which can be collected by 3M Organic Vapor Monitors and desorbed with carbon disulfide or other suitable solvents. A provisional list of organic vapors that can be determined is given in supplementary publications titled "3M Organic Vapor Monitor #3500 Analysis Guide" and "3M Organic Vapor Monitor Sampling Guide".

Calibration curves are generated for each contaminant of interest by injecting known amounts of the compound into a gas chromatograph and recording the response. Interferences will be treated in the Discussion Section.

I. SUMMARY OF METHOD

The organic vapors are adsorbed on high activity charcoal, desorbed with carbon disulfide or other suitable solvent and quantitated using a gas chromatograph equipped with a flame ionization detector.

II. APPARATUS

Organic Vapor Monitors - 3M Brand No. 3500 and 3520.

Features: Sampling rate controlled by molecular diffusion.
Each collecting layer has 160 milligrams of charcoal.

Gas Chromatograph - Hewlett Packard, Model 5840A, or equivalent, equipped with a flame ionization detector - available from Hewlett Packard, 2025 West Larpenteur Ave., St. Paul, MN 55113

Analytical Columns and Parameters - A list of suggested columns is given in Table 1*. Column parameters should always be adjusted to produce sharp symmetrical peaks with as much resolution as possible from interfering components. Carrier gas flow rates are nominaly set at 25 cm^3/min. for packed columns 1/8 inch in diameter.

Vials: Size - 3.2 mm x 1.1 mm, Volume - 1 ml.
Part No. 3-3123

Caps: Equipped with Teflon liners.

Cap Crimper: Part No. 3-3195 available from Supelco.

REAGENTS

Carbon Disulfide - Highest purity available

Solvents - To prepare standards the ideal standard material is a sample of the compound to be measured. Otherwise use AR grade or better solvents.

* Capillary columns exhibits much better resolution than packed columns, but because of variance in manufacturing and performance, no capillary columns are listed.

Gas Chromatograph Supplies - Pressurized bottles of:

1. Helium for carrier gas use must meet or exceed laboratory Grade D 99.995% pure.
2. Nitrogen for carrier gas use must meet or exceed laboratory Grade E 99.98% pure.
3. Hydrogen for flame detector must meet or exceed Grade A 99.8% pure.
4. Air for flame detector must meet or exceed industrial Grade Type 1.

Caution: High pressure containers are hazardous and should be handled with care. Do not store in extreme heat.

Calibration Standards - A series of standard solutions are prepared for each solvent to be determined. A microliter syringe is used to inject an appropriate amount of a particular compound into a known volume of carbon disulfide or other suitable solvent. Nominally 10, 25, and 50 ml glass - stoppered volumetric flasks are used. For the more volatile compounds, known amounts are added to measured quantities of solvent contained in vials equipped with Teflon - lined caps. The vials are immediately inverted and left in that position until used. These solutions are used to prepare a reference calibration curve for the particular organic vapor of interest. Normally, 2 uL of each of the standard solutions are injected into a gas chromatograph and the peak area for each concentration is recorded. A best fit line is calculated by the regression technique to correlate peak area with the weight of component(s) present. It is recommended that the calibration and monitor samples be the same size.

An alternate method to the regression line is to average the resultant sensitivity factors of three individually prepared standards. Sensitivity factors are determined by the ratio of weight to area units.

Caution: Carbon disulfide is toxic and should be handled in a hood. Standard solutions should be used as soon as possible. They may be stored in the laboratory refrigerator for no more than five days.

III. SAMPLING

Check the "USE BEFORE" date stamped on the monitor carton to insure that the monitors are still within their usable life. The monitor is removed from the package and the exposure start time is recorded on the back of the badge. When personal sampling is being performed, the monitor should be attached near the breathing zone. For area sampling, the monitor should NOT be placed in a corner or along a wall where stagnant air may exist. At the conclusion of the sampling period, the badge is removed and the retaining ring along with the membrane are discarded. The elutriation cap is then immediately snapped on terminating monitor exposure and the end time is recorded on the back of the badge. The following information should be recorded for each sample:

1. Monitor number.
2. Date exposed.
3. Employee or Area I.D.
4. Organic vapor of interest along with suspected contaminants which could cause interference.
5. Temperature and relative humdity of the monitored environment if considered extreme.
6. Any comments or unusual circumstances.

IV. SAMPLE ANALYSIS

Using a repipet or a syringe, add 1.5 mL of the desorption reagent to each monitor through the center port (the port is immediately resealed). After 30 minutes, with occasional gentle agitation, the eluent is decanted into a marked auto-sampler vial where a 2 uL sized sample is automatically introduced into the gas chromatograph. Alternatively, a 2 uL aliquot is removed from the center port for manual injection. The resultant analysis is recorded on a chromatogram where area units of the desired component(s) are correlated with the amount (weight) present during the sampling period. The weight found is recorded and converted to mg/m^3 and/or ppm. If the weight collected, for a single contaminant, is greater than the defined capacity (listed in "3M Organic Vapor Monitor #3500 Analysis Guide") then the validity of the sample should be questioned. When sampling multiple contaminants, the combined weights of the contaminants collected should not exceed the defined value for the single contaminant with the lowest capacity.

Calculation of Contaminant Concentrations

Determine the weight of contaminant(s) present in each sample by use of the calibration data (regression equation or sensitivity factor) generated from the prepared standards. The sample weight should always be corrected by subtracting any interferring contributions made from a control blank.

The time-weighted-average concentration of the environment sampled can be calculated by knowing the length of the sampling period, the contaminant weight determined by gas chromatography, the recovery coefficient and the calculation constant either A or B. The calculation constant A is used to calculate the concentration when expressed in units of milligrams per cubic meter (mg/m^3) and constant B when expressed in units of parts per million (ppm). The calculation constant A and B have been determined for all the compounds listed in "3M Organic Vapor Monitor #3500 Analysis Guide".

The time-weighted-average concentration in milligrams per cubic meter of any (listed) contaminant present in the environment sampled can be calculated from the following expression:

$$C(mg/m^3) = \frac{W \text{ (micrograms)}}{rxt \text{ (minutes)}} \times A$$

The time-weighted-average concentration in parts per million (ppm) of the contaminant can be calculated from the following expression:

$$C(ppm) = \frac{W \text{ (micrograms)}}{rxt \text{ (minutes)}} \times B$$

Where W = corrected contaminants weight recovered.

r = recovery coefficient

t = length of sampling period

$$A = \frac{1000}{\text{Sampling Rate}}$$

$$B = \frac{(1000) \times (24.45)}{\text{Sampling Rate} \times \text{Molecular Weight}}$$

The above expressions calculate the time-weighted-average concentrations at a sampling temperature of 25°C (298°K) and pressure of 760 mm. When sampling at other environmental conditions, the above expressions need to be corrected only for variations in temperature. The above expessions can be multipled by the following temperature correction factors (CF_T) for samples collected at temperatures other than 25°C (77°F).

Sampling °C	Temperature °F	Temperature Correction Factor CF_T
44	111	.97
37	99	.98
31	88	.99
25	77	1.00
19	66	1.01
13	55	1.02
7	45	1.03
2	36	1.04
-3	27	1.05
-8	18	1.06

From the previous table, every 10-11° above or below 77°F requires a one percent correction to the calculated time-weighted-average concentration.

If the temperature correction is desired, the time-weighted-average concentration can be calculated by the following expression:

$$C(mg/m^3) = \frac{W\ (micrograms)}{rxt\ (minutes)} \times A \times CF_T$$

$$C(ppm) = \frac{W\ (micrograms)}{rxt\ (minutes)} \times B \times CF_T$$

<u>Example Calculation</u> (Trichloroethylene)

Length of sampling period (t)	465 minutes
Temperature (T)	19°C
Calculation constant (A)	32.2
or constant (B)	6.0
Corrected Toluene Weight (W)	768 micrograms
Recovery coefficient (r)	1.00

Using calculation constant (A):

$$C(mg/m^3) = \frac{768}{(1.00)(465)} \times 32.2 \times 1.01$$

$C = 53.7\ mg/m^3$

Using calculation constant (B):

$$C(ppm) = \frac{768}{(1.00)(465)} \times 6..00 \times 1.01$$

$C = 10.0\ ppm$

DISCUSSION

Experience teaches that a single contaminant is rarely found by itself in a given industrial atmosphere. Depending on the number and nature of the contaminating organic vapors, it is possible that interferences may occur. To help insure the accuracy of an analytical result, a sample may be analyzed on two chemically different natured columns (Carbowax vs. SE-30). If the results are essentially the same for both columns, there is a good chance no interferences are present. However, no absolute identification can be made for any contaminant(s) by retention time only, regardless of the number of analytical columns used.

TABLE 1

Analytical Columns	Use
10% FFAP, Chromosorb W AW, 10 ft. x 1/8 in. SS	General, Free Fatty Acid
*15% carbowax 20m, Chromosorb W, 7.5 ft. x 1/8 inc. SS	General, Chlorinated
Porapak Q, 6 ft. x 1/8 inc. SS	Low MW Halogens
10% FFAP, Chromosorb W AW, 20 ft. x 1/8 inc. SS	General, Solvent
25% CEF, Chromosorb P AW, 10 ft. x 1/8 inc. SS	Benzene, Aromatics
5% OV-17, Supelcoport, 6 ft. x 4 mm glass	General, Drugs, Pesticides
10% OV-101, Supelcoport, 10 ft. x 1/8 inc. SS	General
10% SP-2100, Supelcoport, 10 ft. x 1/8 inc. SS	General, Hydrocarbons
1.75% Bentone 34/5% SP1200, 10 ft. x 1/8 inc. SS	Xylene, Aromatics
*20% SP2100 0.1% carbowax 1500 on 100/120 mesh Supelcoport 10 ft. x 1/8 in. SS	

* Primary columns packed

Recommended Procedure For Determination of Recovery Coefficients For 3M Organic Vapor Monitor #3500

3M publishes the Recovery Coefficient for many of the organic vapors in the 3500 Compound Guide. This number represents the mean value ± 2 standard deviations from the tests conducted at 3M. A minimum of 5-fold replication (both monitors and standards) of the recovery test is performed at 3M. However, we encourage the user to verify the recovery coefficients, since techniques and presence of multiple contaminants can affect recovery coefficients.

The recovery coefficient is determined by vapor-state spiking of monitors. This is accompanied by the following steps:

1) Remove plastic ring and white film from a monitor.
2) Place a 2.5 m. diameter Whatman #5 filter paper on spacer plate.
3) The closure cap is snapped on the monitor.
4) Calculate the amount of material to be injected. The following formula will calculate the injection amount, in milligrams, that corresponds to the amount that would be collected by a monitor at sampling conditions chosen. By varying the chosen concentration levels and exposure times, a Recovery Coefficient curve can be generated.

$$W = (K_O) \times (C) \times (t) \times (10^{-6}\ m^3/cm^3)$$

Where:

W = Amount of liquid injection in milligrams
K_O = Sampling rate of monitor cm^3/min.
C = Average concentration in mg/m^3
t = Sampling time in minutes

For compounds that are solid at room temperature, prepare a solution in Carbon Disulfide such that no more than a 5 microliter injection is needed to spike the required number of milligrams of the compound.

A suggested starting point would be assuming an average concentration of one P.E.L. (Permissible Exposure Limit) and an 8 hour exposure period, as long as the amount in milligrams does not exceed the recommended exposure limit of monitor.

5) Inject the known quantity of the organic material onto the filter paper through the center port.
6) The monitor is allowed to sit 16-24 hours to allow total transfer of the organic material from the filter paper to the sorbent before elution.
7) Remove filter paper from monitor.
8) Proceed with elution and determination of amount recovered by G.C. analysis. See Sec VII Steps 2-5 of #3500 Organic Vapor Monitor Instructions for Use.

For further assistance, call 3M Occupational Health and Safety Products Technical Service toll free on 1-800-328-1300, or write 3M, 3M Center, Occupational Health and Safety Products Division, P.O. Box 33155, St. Paul, MN 55144.

R 35RDRC(U11)R1 Litho in U

3M
Organic Vapor Monitor

Sampling Rate
Validation Protocol

Another Step Towards Better Occupational Health and Safety

R-35VP(61.1)R1

Litho in U.S.A.

Occupational Health and Safety Products Division/3M
220-7W 3M Center
St. Paul, MN 55144

Regression curves for compound classification.

1.	Ketones	
2.	Alcohols	
3.	Aliphatics	$K = 365.39\ D + 3.80$
4.	Cellosolve	
5.	Esters	
6.	Aromatics	$K = 430.49\ D - 5.54$
7.	Other cyclic compounds	
8.	Halogenated	$K = 291.20\ D + 5.77$

The regression curves are best fit lines represented by the following general equation.

$$K = mD + C$$

where

K = sampling rate (cm^3/min)

m = slope of best fit line $\left(\frac{cm^3/min}{cm^2/sec}\right)$

D = diffusion coefficient (cm^2/sec)

C = constant intercept term (cm^3/min)

Sampling Rate Validation

The sampling rates for the (*) contaminants were determined by sampling a known air concentration in a laboratory generator-dilution system. This system consisted of a calibrated dry air gas meter, a syringe drive mechanism to deliver the liquid contaminant to a heat manifold, and an exposure device to hold six (6) monitors. The air concentrations of the contaminant were generated by delivering the contaminant at a known rate to an air flow through the heated manifold.

For the exposure period, the air concentration can be determined by measuring the total air volume and the initial and final weight of the syringe containing the contaminant. Five concentrations at one-tenth, one-half, one, two and four times the permissible exposure limit (PEL) were generated to measure the sampling rates. For the sampling rate validations, six samples at each of the five concentrations were collected. The recovery coefficients were determined by spiking the monitors with known amounts of the contaminant at the level corresponding to amounts collected when sampling air concentrations ranging from one-tenth to four times the permissible exposure level (PEL). Results from the 18 spiked samples (3 sets of 6 samples) and the 30 exposure samples results were used to form the basic statistical set of data.

In the sampling rate validation exposure, the monitors sampled known air concentration containing three to five contaminants. The length of the exposures were:

2 Hrs. — .1 PEL
2 Hrs. — .5 PEL
2 Hrs. — 1 PEL
1 Hr. — 2 PEL
.5 Hr. — 4 PEL

The validation results were treated according to the statistical protocol outline in the Documentation of the NIOSH Validation Tests DHEW No. 77-185. The validated sampling rates are tabulated for each contaminant as the mean of 30 samples with the variation reported as the precision of the sampling rate. These results along with the diffusion coefficients as calculated by the Hirschfelder equation are tabulated in Tables I, II and III. The technique for calculating the diffusion coefficient according to the Hirschfelder equation is outlined in Appendix A.

In Figure 1, the validated sampling rates are plotted as a function of the calculated diffusion coefficients for alcohols, aliphatics, cellosolves, esters and ketones. From a least squares fit of the data, the variation of sampling rate is ± 5%. In Figure 2, the validated sampling rates are plotted as a function of the calculated diffusion coefficient for aromatics and other cyclic compounds. In Figure 3, the validated sampling rates are plotted as a function of the calculated diffusion coefficient for the halogenated compounds.

For the compounds in the Sampling Guide and Analysis Guide other than those tabulated in Tables I, II and III, the sampling rates were determined from the diffusion coefficients calculated according to the Hirschfelder equation as outlined in Appendix A and the empirical relationships defined in Figures 1, 2 and 3. By this technique, it is possible to determine the sampling rates with an accuracy of at least ± 5%.

Table I

Compound	Hirschfelder Diffusion Coefficient (cm^2/sec)	Measured Sampling Rate (cc/min ± s.d.)
Ketones		
Acetone	.1096	40.1 ± .9
Diisobutyl Ketone	.0606	24.6 ± .8
Methyl Butyl Ketone	.0756	29.7 ± .7
Methyl Isobutyl Ketone	.0761	30.0 ± .4
Methyl Ethyl Ketone	.0943	36.3 ± .9
Methyl Propyl Ketone	.0838	33.0 ± .5
Alcohols		
n-Amyl Alcohol	.0787	31.2 ± .4
i-Amyl Alcohol	.0790	32.3 ± .4
Butyl Alcohol	.0879	34.3 ± .7
Diacetone Alcohol	.0707	28.2 ± .4
i-butyl Alcohol	.0908	35.9 ± .7
Propyl Alcohol	.1004	39.7 ± .7
Aliphatics		
Heptane	.0721	28.9 ± .7
Hexane	.0796	32.0 ± .7
Nonane	.0617	24.6 ± .6
Octane	.0664	26.6 ± .6
Pentane	.0864	34.5 ± .8
Cellosolve		
Butyl Cellosolve	.0681	28.2 ± .6
Cellosolve	.0820	32.4 ± .9
Cellosolve Acetate	.0682	26.6 ± .4
Methyl Cellosolve	.0911	36.3 ± .4
Methyl Cellosolve Acetate	.0740	29.0 ± .5
Esters		
n-Amyl Acetate	.0668	26.0 ± .5
s-Butyl Acetate	.0728	28.6 ± .4
Ethyl Acetate	.0883	34.5 ± .6
i-Butyl Acetate	.0793	31.0 ± .3
Methyl Acetate	.1009	37.0 ± .6
Propyl Acetate	.0793	30.1 ± .5

Table II

	Hirschfedler Diffusion Coefficient (cm²/sec)	Measured Sampling Rate (cc/min ± s.d.)
Aromatics & Other Cyclic Compounds		
Benzene	.0947	35.5 ± .6
p.tert-Butyl Toluene	.0599	20.7 ± .4
Cumene	.0690	24.5 ± .9
Mesitylene	.0660	26.3 ± .7
Alpha Methyl Styrene	.0700	25.0 ± .5
Styrene	.0764	26.8 ± .8
Toluene	.0827	31.4 ± .6
Xylene	.0748	27.3 ± .5
Cyclohexanone	.0802	28.9 ± .3
Isophorone	.0635	21.7 ± .7
Cyclohexane	.0851	32.4 ± .7
Cyclohexene	.0876	32.3 ± .4
Methyl Cyclohexane	.0769	28.9 ± .4
Cyclohexanol	.0760	29.5 ± .3

Table III

Compound	Hirschfelder Diffusion Coefficient (cm²/sec)	Measured Sampling Rate (cc/min ± s.d.)
Halogenated		
Carbon Tetrachlordie	.0857	30.2 ± .4
Chlorobenzene	.0812	29.3 ± .6
Chlorobromomethane	.1005	34.4 ± .9
o-Dichlorobenzene	.0732	27.8 ± .6
1,2 Dichloroethylene	.0992	35.2 ± .5
Ethyl Bromide	.1013	36.4 ± .3
Ethylene Dibromide	.0824	29.6 ± .4
Ethylene Dichloride	.0973	33.2 ± .7
Methylene Chloroform	.0855	30.9 ± .3
Methylene Chloride	.1102	37.9 ± .3
Perchloroethylene	.0786	28.3 ± .5
Propylene Dichloride	.0833	30.6 ± .4
1,1,2 Trichloroethane	.0836	29.7 ± .6
Trichloroethylene	.0874	31.1 ± .2

Sampling Rate As a Function of Diffusion Coefficient

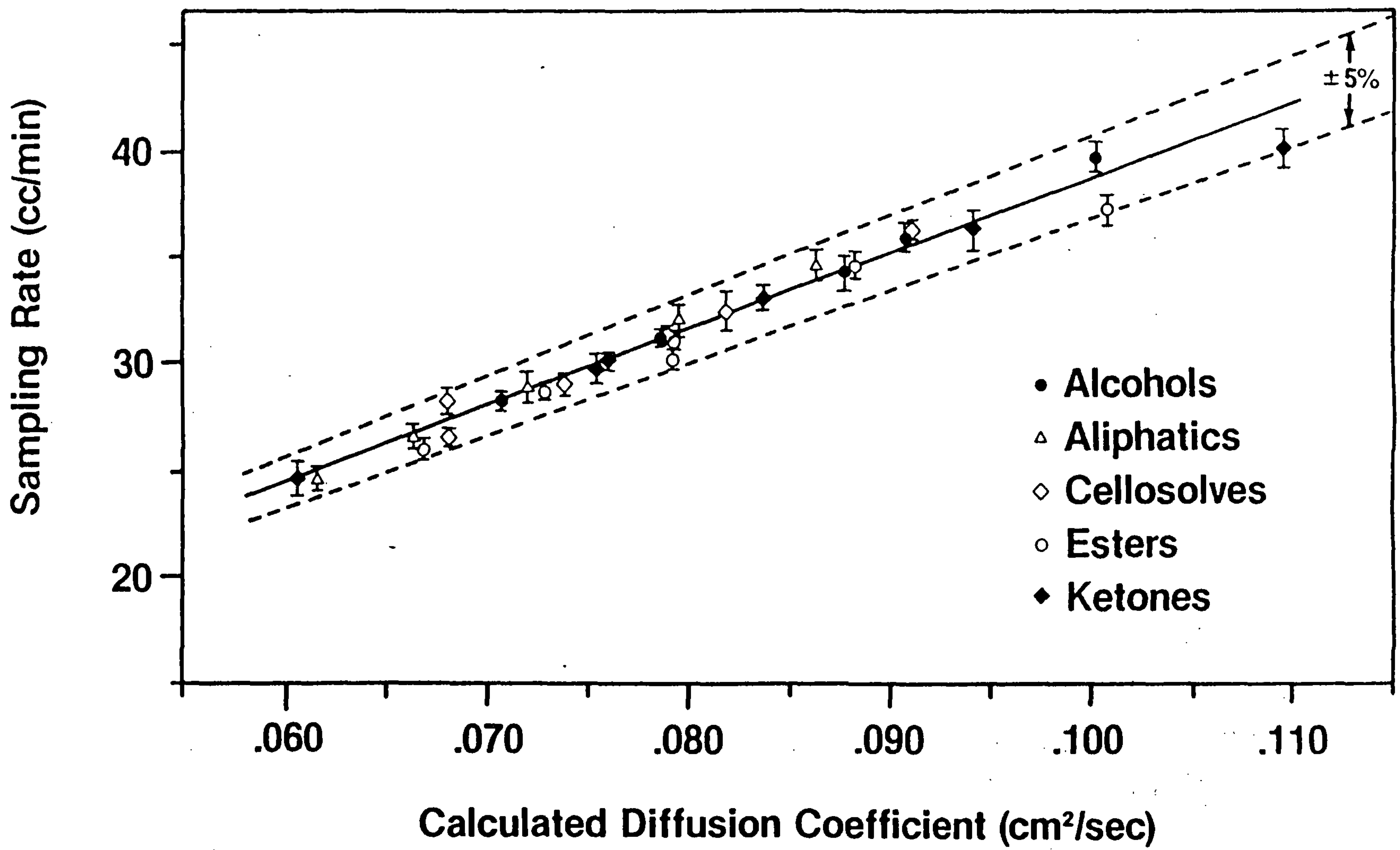


Figure 1

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Sampling Rate As a Function of Diffusion Coefficient

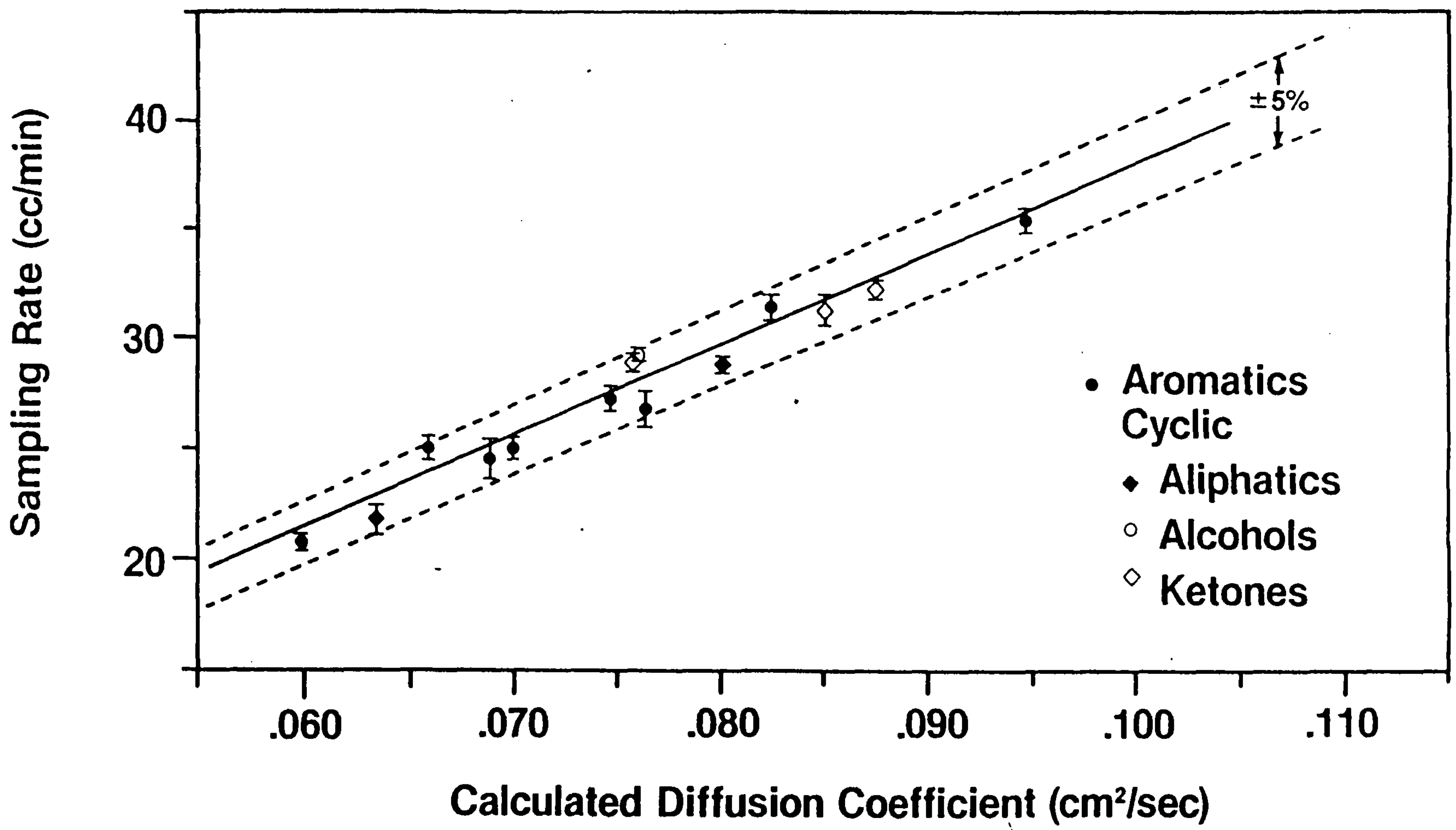

Figure 2

Sampling Rate As a Function of Diffusion Coefficient

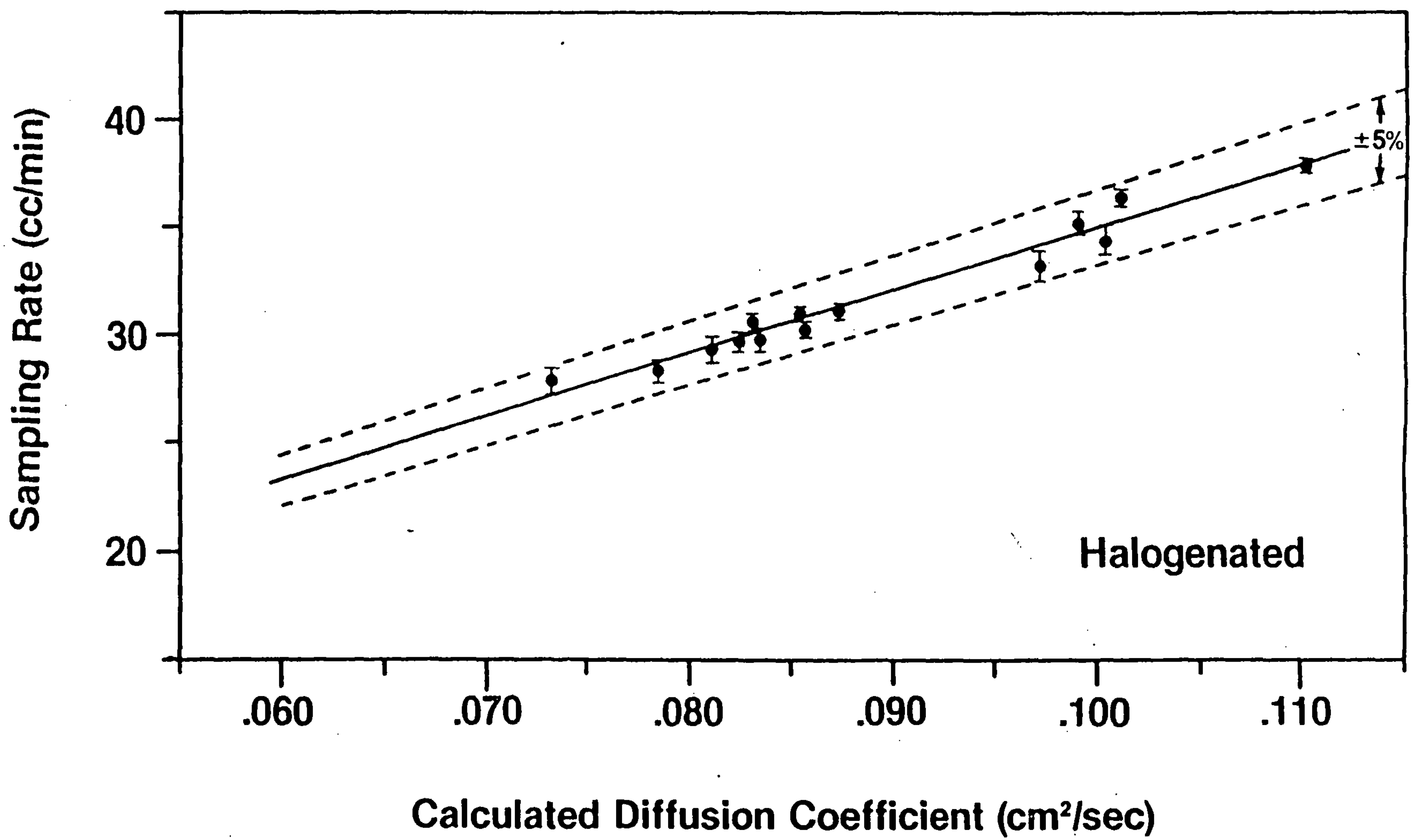

Figure 3

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Appendix A

Calculation of Diffusion Coefficient

Because diffusion coefficients are not available for all contaminants from the same experimental determination, it is therefore desirable to use accurate estimations as determined from the Wilks and Lee modification (Ind. Eng. Chem. 47,1253 [1955] of the equation by Hirschfelder, Bird and Spots (Trans. Am. Soc. Mech. Engrs., 71,921 [1949] as outlined in J. H. Perry, Ed. [Chem. Engrs. Handbook]).

It has been shown that excellent empirical correlation can be achieved between measured sampling rates and the calculated diffusion coefficients. Therefore, the sampling rates which were not measured can be determined with an accuracy of $\pm 5\%$ from the calculated diffusion coefficients using the emplirical relationship. The following outlines the Hirschfelder equation and defines the neccesary parameters needed for calculating the diffusion coefficient according to this technique.

Hirschfelder Equation

$$D_g = \frac{B T^{3/2} \sqrt{1/M_1 + 1/M_2}}{P\, r_{12}^2\, I_D}$$

Where

D_g = gas diffusivity (cm^2/sec)

B = $\left[10.7 - 2.46\sqrt{1/M_1 + 1/M_2}\right] \times 10^{4}$

T = absolute temperature (°K)

M_1, M_2 = molecule weights of components 1 and 2

P = absolute pressure (atm)

r_{12} = collision diameter Å

= $(r_1 + r_2)/2$

I_d = collision integral for diffusion, function of kT/ε_{12} (see Table I-Appendix A)

$$\frac{\varepsilon_{12}}{k} = \sqrt{\left(\frac{\varepsilon_1}{k}\right)\left(\frac{\varepsilon_2}{k}\right)}$$

k = Boltzmann constant
= 1.38×10^{-6} erg/°K

ε_{12} = energy of molecular interaction (ergs)

$\frac{\varepsilon}{k}$ = $1.15\, T_b$

= $1.92\, T_m$

T_b = temperature of component boiling point (°K)

T_m = temperature of component melting point (°K)

Combining and simplifying the above expressions:

$$\frac{\varepsilon'}{k} = \text{air value } (97\,^\circ K)$$

$$\frac{\varepsilon_{12}}{k} = \sqrt{(97\,^\circ K)\,(1.15\ T_b)}$$

$$= \sqrt{(97\,^\circ K)\,(1.92\ T_m)}$$

$$\frac{kT}{\varepsilon_{12}} = \frac{298.15}{\sqrt{(97\,^\circ K)\,(1.15\ T_b)}}$$

$$= \frac{28.2}{\sqrt{T_b}}$$

From this value, the collision integral, I_d, can be found from the interpolated values tabulated in Table I of Appendix A.

The radius (r) can be determined from the summation of the atomic volumes tabulated in Table II of Appendix A.

$$r = 1.18\ (V)^{1/3}$$

$$V_2 = \sum v_{atomic} \text{ (see Table II Appendix A)}$$

$$r_1 = 3.62$$

$$r_{12}^2 = \left[(3.62 + 1.18\ V_2^{1/3})/2\right]^2$$

By combining all of the above expressions and values, the first equation can be expressed as the following:

$$D_g = \frac{\left[22.03 - 5.07\sqrt{.0345 + 1/M_2}\right]\left[\sqrt{.0345 + 1/M_2}\right]}{I_d\ (3.62 + 1.18\ V_2^{1/3})^2}$$

Example Calculations:

Methyl acetate $CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}O\text{-}CH_3$

Molecular weight - 74

Boiling point (T_b) - 331°K (58°C)

$$\frac{kT}{\varepsilon_{12}} = \frac{28.2}{\sqrt{331}}$$

$$= 1.55$$

$$I_d = .5914$$

$$V_2 = 3(14.8) + 6\,(3.7) + 7.4 + 7.4$$

$$= 81.4$$

$$\sqrt[3]{V_2} = 4.33$$

$$D_g \quad \frac{(22.03 - 5.07\sqrt{.0345 + 1/74})\ \ (\sqrt{.0345 + 1/74})}{(.5914)\ \ \left[3.62 + 1.18\,(4.33)\right]^2}$$

$$D_g = .1016\ cm^2/sec$$

Appendix A

Table 1

Interpolated Values of Collision Integral

kT/ε_{12}	I_D	kT/ε_{12}	I_D
1.00	0.7197	1.40	0.6166
.01	.7165	.41	.6148
.02	.7132	.42	.6131
.03	.7100	.43	.6114
.04	.7067	.44	.6096
.05	.7035	.45	.6078
.06	.7003	.46	.6061
.07	.6070	.47	.6044
.08	.6938	.48	.6026
.09	.6905	.49	.6008
1.10	0.6873	1.50	0.5991
.11	.6846	.51	.5976
.12	.6819	.52	.5960
.13	.6791	.53	.5945
.14	.6764	.54	.5929
.15	.6737	.55	.5914
.16	.6710	.56	.5899
.17	.6683	.57	.5883
.18	.6655	.58	.5868
.19	.6628	.59	.5852
1.20	0.6601	1.60	0.5837
.21	.6578	.61	.5823
.22	.6554	.62	.5810
.23	.6531	.63	.5796
.24	.6507	.64	.5783
.25	.6484	.65	.5769
.26	.6461	.66	.5755
.27	.6437	.67	.5742
.28	.6414	.68	.5728
.29	.6390	.69	.5715
1.30	0.6367	1.70	0.5701
.31	.6347	.71	.5689
.32	.6327	.72	.5677
.33	.6307	.73	.5665
.34	.6287	.74	.5653
.35	.6266	.75	.5640
.36	.6246	.76	.5628
.37	.6226	.77	.5616
.38	.6206	.78	.5604
.39	.6186	.79	.5592
1.40	0.6166	1.80	0.5580

Appendix A

Table II

LeBas Additivity Values & Rules - $V_2 = \sum V_{atomic}$

Element	Atomic Volue (V)
Carbon	14.8
Chlorine	
Terminal as in R-Cl	21.6
Medial as in R-CHCl-R	24.6
Fluorine	8.7
Hydrogen	3.7
Iodine	37.0
Nitrogen	15.6
In primary amines	10.5
In secondary amines	12.0
Oxygen	12.8
Doubly bound -C(=O)-	7.4
In aldehydes & ketones R-C(=O)-H, R-C(=O)-R	7.4
In methyl esters CH_3-O-C(=O)-R	9.1
In methyl ethers CH_3-O-R	9.9
In higher ethers & esters R-O-C(=O)-R, R-O-R	11.0
In acids R-C(=O)-OH	12.0
In union with S,P,N	8.3
Sulfur	25.6

Special Rules:

(1) Deduct 6 for three membered ring

(2) Deduct 8.5 for four membered ring

(3) Deduct 11.5 for five membered ring

(4) Deduct 15.0 for six membered ring

(5) Deduct 30.0 for naphthalene ring

TECHNICAL DATA from National Draeger, Inc.

Chief Engineer Kurt LEICHNITZ:

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AIR ANALYSES AT WORK PLACES BY MEANS OF SHORT-TERM AND LONG-TERM DETECTOR TUBES

1 General

The occurrence of air pollution cannot always be completely avoided at work places, but there are sufficient possibilities to protect the workers from health hazards. This includes measurements of the toxic substances in the air and – a very important point – evaluation of the exposure[1] on the basis of the measurement results.

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1 **Determination of the average concentration in the area of inhalation over a period of several hours, using long-term detector tubes and Dräger Polymeter pump.**

When the measurement programme is prepared, it can be assumed that the concentration of toxic substances in the work area of the employee differs almost always as a function of time and space. As regards air analysis, this results in the following tasks:

a) Determination of the average concentration over a period of several hours

b) Determination of the range of fluctuation of the concentration

c) Aimed measurements if concentration peaks are suspected.

It should be remembered that the air analysis must be carried out in the area of inhalation of the workers if the exposure is to be evaluated.

The detector tube method (long-term and short-term tubes) is suited for solving this measurement task. The measurement programme can be planned according to statistical rules. The statistics of sample-taking have been discussed in several publications. Although the mathematical principles sometimes appear to be complicated, their practical application is simple.

Taking into account statistical viewpoints, proposals are now to be made on the execution of the measurements. All situations to be expected in practice cannot be covered by this programme, but it is possible to provide at least a basis for establishing a sample-taking schedule which meets practical requirements. The statistical evaluation should be included in the framework of air analysis as a matter of principle.

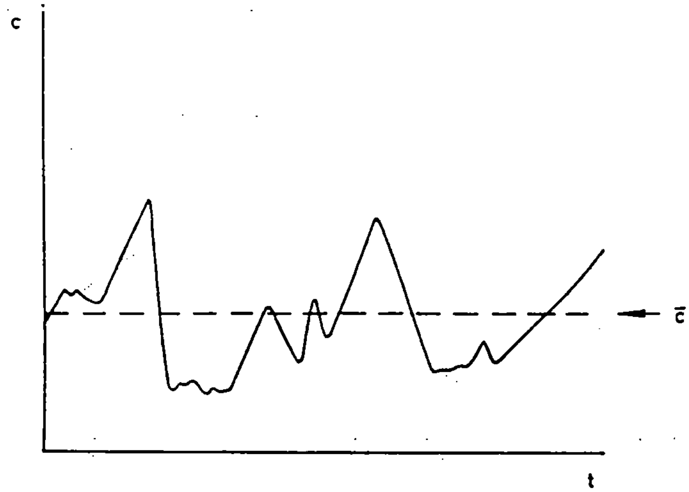
2 Determination of the average concentration in the area of inhalation over a period of several hours by means of long-term detector tubes

2.1 Principle

For this type of measurement the system – consisting of the long-term tube, an extension hose, and the DRÄGER Polymeter long-term pump – is worn by the worker on his body (illustr. 1).

The result of the measurement corresponds to the average concentration (arithmetic mean) to which the person was exposed during the period of measurement (exposure during the monitoring period); cf. illustr. 2 as well.

Note 1: Workers are exposed to toxic substances at their work places; this situation is called exposure.



2

Example for the concentration trend as a function of time; the average concentration $\bar{c}$ (referred to the total time) is also entered.

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The duration of the monitoring period will differ, depending on the problem. It may extend over the entire work shift of normally eight hours.

2.2 Period of use for long-term detector tubes and DRÄGER Polymeter pump

The indication sensitivity of the long-term detector tubes is adjusted to several hours of use. If concentrations amounting to several times the threshold limit value are present, indications which can be evaluated will be obtained after a shorter period of time (e. g., 15 min). It is thus possible to monitor for short periods as well.

The Polymeter has a period of use of eight hours. Not all the long-term detector tubes can be used yet for up to eight hours; it may therefore be necessary to use two or four tubes in succession during an eight-hour shift. The result of the respective individual measurement is a measure of the average concentration during the individual monitoring period. In order to calculate the average concentration for the eight-hour shift, the arithmetic mean is formed from the two or four individual values.

2.3 Sample-taking techniques with long-term tubes to determine the average concentration

a) The long-term tube has a capacity which is sufficient for eight hours. Only one tube per shift is used. The result of the measurement is the average concentration ($\bar{c}$) during the monitoring period of eight hours (e. g., $\bar{c}$ = 75 ppm).

b) The long-term tube has a capacity which is sufficient for four hours. Two tubes per shift are used.
Result of the first measurement:
Average concentration $\bar{c}_1$ during the monitoring period of the first four hours (e. g., $\bar{c}_1$ = 65 ppm).

Result of the second measurement:
Average concentration $\bar{c}_2$ during the monitoring period of the second four hours (e. g., $\bar{c}_2$ = 85 ppm).

Formation of the average of the first and second results yields the average concentration $\bar{c}$ during the entire period of monitoring:

$$\bar{c} = \frac{65 + 85}{2} = 75 \text{ ppm}$$

c) The long-term tube has a capacity for two hours. Four tubes are used per shift. Evaluation and formation of average can be derived from example b.

3 Determination of the range of fluctuation of the concentration when using short-term detector tubes

3.1 Logarithmic normal distribution

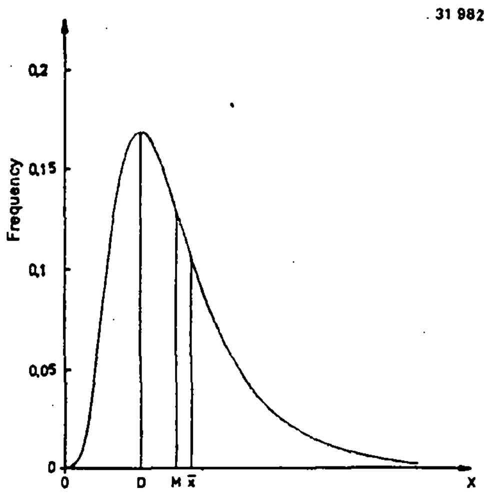
A logarithmic normal distribution of the concentration is assumed in the method described below. Particularly for the determination of dust in the air of work places, a relation between the dust concentration and the frequency of occurrence of the concentrations was observed a long time ago. This relation can be described by the logarithmic normal distribution; Juda and Budzinski [1] reported on this distribution after having evaluated several thousand measurements.

The curve of the logarithmic normal distribution is shown in illustr. 3. For comparison's sake, the Gaussian bell-shaped curve, known from mathematics, is given in Illustr. 4; the standard distribution can be described by this curve. While the standard distribution has a symmetrical shape, the curve for the logarithmic normal distribution has a steeper slope on the left side and is flatter on the right side. The logarithmic normal distribution will be encountered whenever the feature, e. g., the gas concentration, cannot drop below a certain value, such as zero, but when high values occur, although rarely. According to Sachs [2], the logarithmic normal distribution is observed whenever biological or economic aspects predominate. This includes, among other things, the income of wage earners.

Naumann [3] reports on air analyses in a work room in which the SO_2 concentration fluctuated. The fluctuation followed the logarithmic normal distribution, and Naumann explains the mathematical connections.

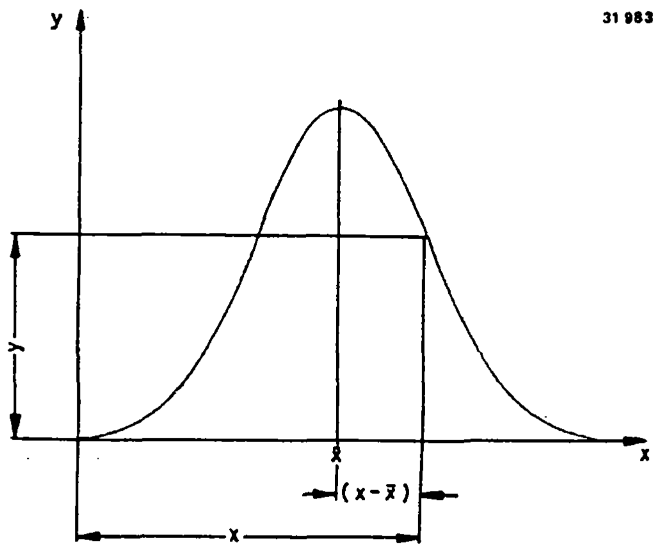
On the basis of experience obtained so far about frequency distributions of gas concentrations at work places, the National Institute for Occupational Safety and Health (NIOSH) in the U.S.A. proposed to adjust sample-taking and evaluation of the measurement results to the logarithmic normal distribution [4].

The theoretical connections of sample-taking statistics have thus been explained in great detail in various publications. Their application to practical problems is to be discussed in this paper.



Logarithmic normal distribution
D Mode
M Median value
x̄ Arithmetic mean

3



4 **Gaussian standard distribution**
x̄ Arithmetic mean

3.2 Sample-taking schedule for short-term measurements

A total of ten individual measurements is the basis for the programme presented here. These measurements are taken as "snapshots" during the period of monitoring (e. g., eight hours), using short-term tubes and a bellows pump. The various measuring moments must be selected at random [5].

It may appear rather arbitrary to set up the sample taking schedule, presented here, on a total of ten individual measurements. Studies conducted in the U.S.A. [5] have shown that this number can be considered adequate for many instances to be expected in practice.

The sequence of short-term measurements by means of detector tubes and the statistical evaluation are explained by way of an example.

3.2.1 First step (duration of a single measurement):

Estimate of the duration of a single measurement by way of short-term detector tubes; the duration is, e. g., 4 min (the duration depends on the type of detector tube and may differ from 4 min).

3.2.2 Second step (the monitoring period is subdivided):

Subdivision of the entire monitoring period into time intervals corresponding to the duration of a single measurement (4 min).

The monitoring period is to begin at 6.00 a. m.

Duration of the monitoring period: eight hours (corresponding to one work shift).

The corresponding time intervals (4 min each) are listed in table 1 (tables for other time intervals can be compiled without difficulty by the user himself); a total of nine hours is taken into account because – as will be shown later on – the intermissions are not included in the monitoring period.

The work hour 1 of the table would last from 6.00 a. m. to 7.00 a. m. in our example. Hour 2 would last from 7.00 a. m. to 8.00 a. m.

In our example, the period from 6.00 a. m. to 6.04 a. m. can be found in the table as time interval N° 1. This is followed by time interval N° 2, lasting from 6.04 a. m. to 6.08 a. m.

Each hour must be subdivided into 15 time intervals. Nine hours will result in a total of 135 intervals.

3.2.3 Third step (random selection of the measuring time intervals):

Ten intervals must be selected at random from the 135 possibilities. According to Lindner [6] the procedure normally used in games of chance can be employed; in these games, the random situation is reached by shuffling cards, drawing balls, or turning a lottery wheel.

Kayser [7] recommends special random dies on which the following numbers are printed:

First die:	0,	1,	2,	3,	4,	5
Second die:	0,	6,	12,	18,	24,	30
Third die:	0,	36,	72,	108,	144,	180

When the dice are thrown, the sum of the numbers is formed; three dice cover the range from 0 to 215.

Random numbers obtained by throwing die have been compiled in table 2. All numbers above 135 habe been omitted because they are not required for selecting the time intervals of our example. The decision as to which column of table 2 is to be used can be taken arbitrarily. It is also possible to write the figures 1, 2, 3 and 4 on one card each and to draw a card. If the card carrying figure 2 is drawn, the random numbers of the second column of table 2 are to be used.

Intermissions are left out in the measurement programme. If time intervals occur during intermissions, more than ten numbers must therefore be obtained from the series of random numbers. The random numbers in our example are 79, 31, 50, etc. Since there is an intermission between 8.00 a.m. and 8.15 a.m., the time intervals identified by the numbers 31 to 34 must be omitted. The same holds for the period from 11.30 a.m. till noon; in this case, the numbers 83 to 90 are omitted.

This leaves us with the following intervals for the measurement:
29, 44, 50, 68, 76, 79, 80, 101, 111, 121.

3.2.4 Fourth step (execution of the measurements):

Ten measurements (by way of short-term detector tubes) are carried out in the area of inhalation at the intervals mentioned. The following results are obtained:

Time interval	Time	CO concentration
29	7.52 - 7:56	15 ppm
44	8.52 - 8.56	5 ppm
50	9.16 - 9.20	30 ppm
68	10.28 - 10.32	7 ppm
76	11.00 - 11.04	20 ppm
79	11.08 - 11.12	70 ppm
80	11.12 - 11.16	50 ppm
101	12.40 - 12.44	30 ppm
111	13.20 - 13.24	20 ppm
121	14.00 - 14.04	10 ppm

3.2.5 Fifth step (arrangement of the measured data):

The ten individual measured data are arranged in the order of increasing concentration, starting with the lowest value:

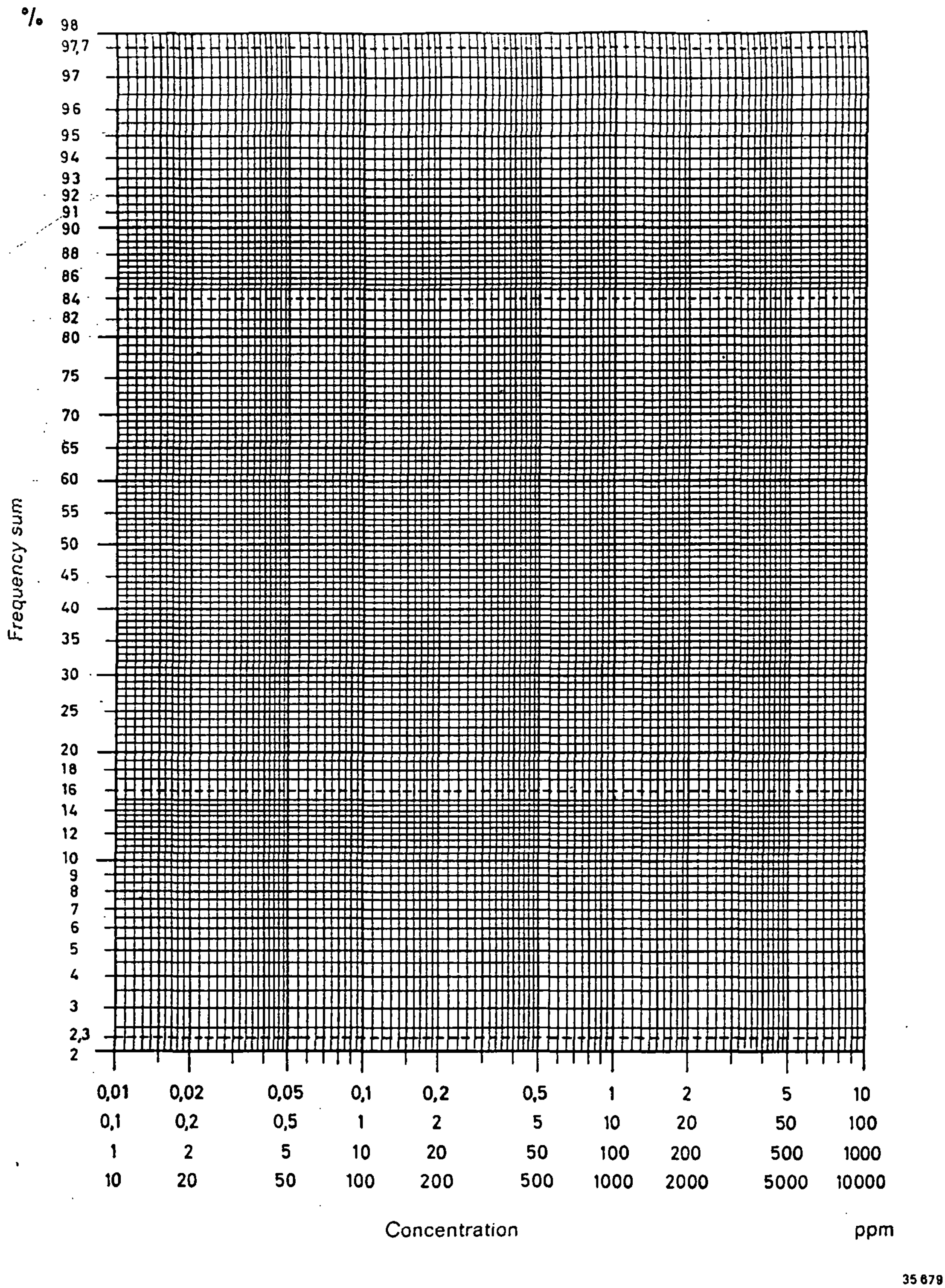
5 ppm, 7 ppm, 10 ppm, 15 ppm, 20 ppm, 20 ppm, 30 ppm, 30 ppm, 50 ppm, 70 ppm.

3.2.6 Sixth step (graphic evaluation of the measurement results):

The results are then entered in a probability network (illustr. 5), with the frequency sum and the concentration as coordinates[2]. The positions for entering the data are obtained from table 3, and the following data are obtained:

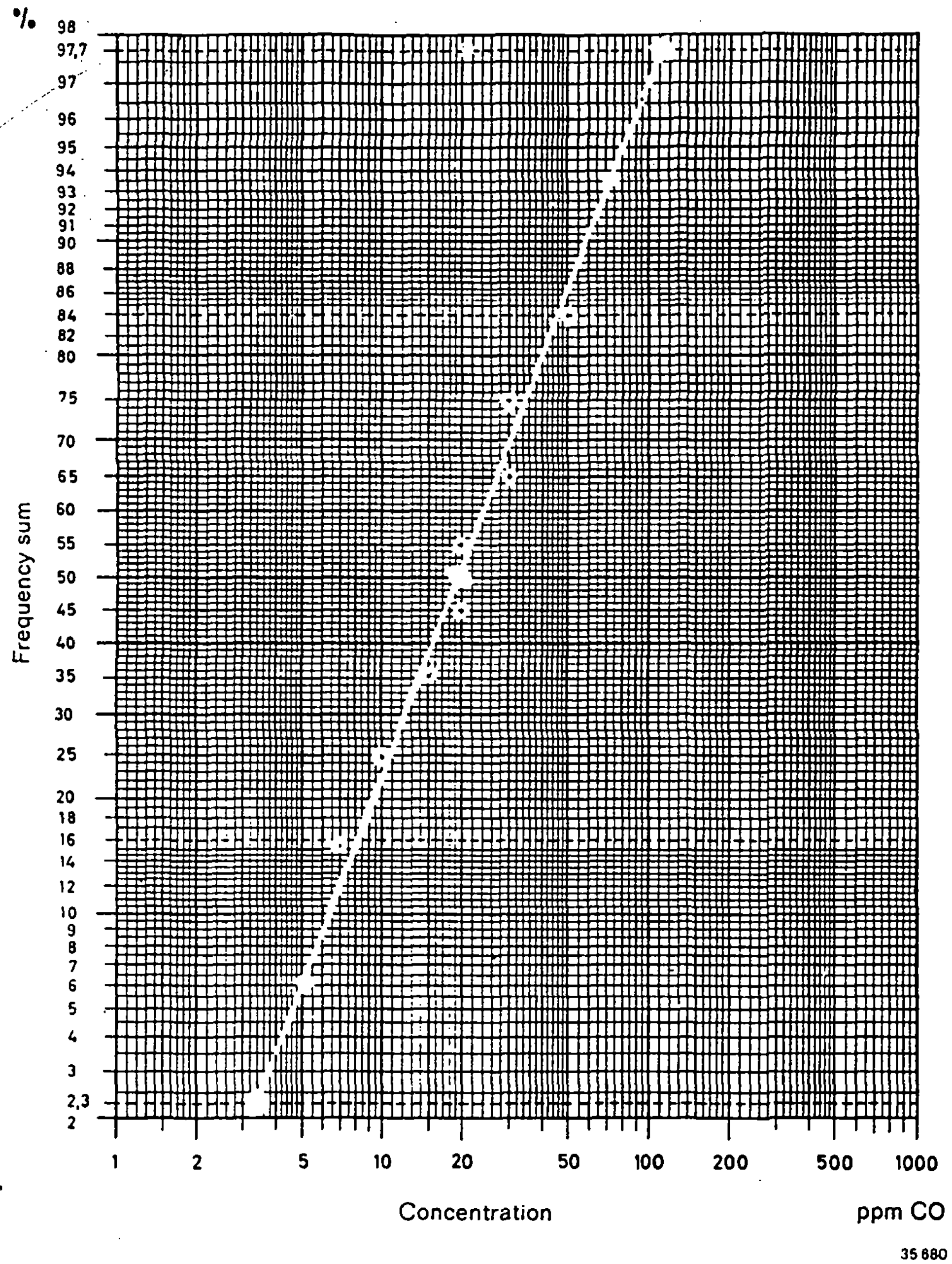
Concentration	Frequency sum
5 ppm	6.2 %
7 ppm	15.9 %
10 ppm	25.5 %
15 ppm	35.2 %
20 ppm	45.2 %
20 ppm	54.8 %
30 ppm	64.8 %
30 ppm	74.5 %
50 ppm	84.1 %
70 ppm	93.8 %

Note 2: A suitable probability network (ordinate according to the Gaussian integral, abscissa logarithmic) is supplied, for instance, by Messrs. Schleicher and Schüll GmbH, D-3352 Einbeck/F. R. of Germany (order N° 667456, N° 440 ½ A 4).



5 **Probability network –**
Ordinate according to the Gaussian integral (frequency sum) Abscissa with logarithmic subdivision.

Ten points are obtained through which a straight line matching the data as well as possible must be drawn (illustr. 6).



6 **Plotting of ten measured values (ppm) in the probability network**
(position of the frequency sum from table 3)

3.2.6.1 Deviation from the linearity

It will not always be possible to represent the relationship between the frequency sum and the concentration by a straight line. Leidel [5] made proposals as to how the data are to be treated in the absence of logarithmic normality (i. e., no linear correlation between the frequency sum and the concentration, as shown in illustr. 7, for instance); the desired linearity can often be obtained by a process termed transformation in mathematics. To which extent advantages are thereby obtained for practical conclusions is yet to be examined on the basis of series of measurements.

We would suggest to draw the appropriate conclusions from the non-modified graphic presentation. Any deviation from the linearity indicates that the concentrations do not follow a logarithmic normal distribution; this, in turn, suggests that there were changes in the concentration development during the monitoring period which are no longer subject to the random distribution. This may include, for instance, basic changes in the ventilation conditions (e. g., failure of fans), appearance of new leaks, change in work place, or completion of a specific operation.

In such instances, the monitoring periods will be subdivided differently in case of repeated measurements. A graphic evaluation of the new results will then usually yield the desired linearity.

3.2.6.2 Estimate of the concentration range

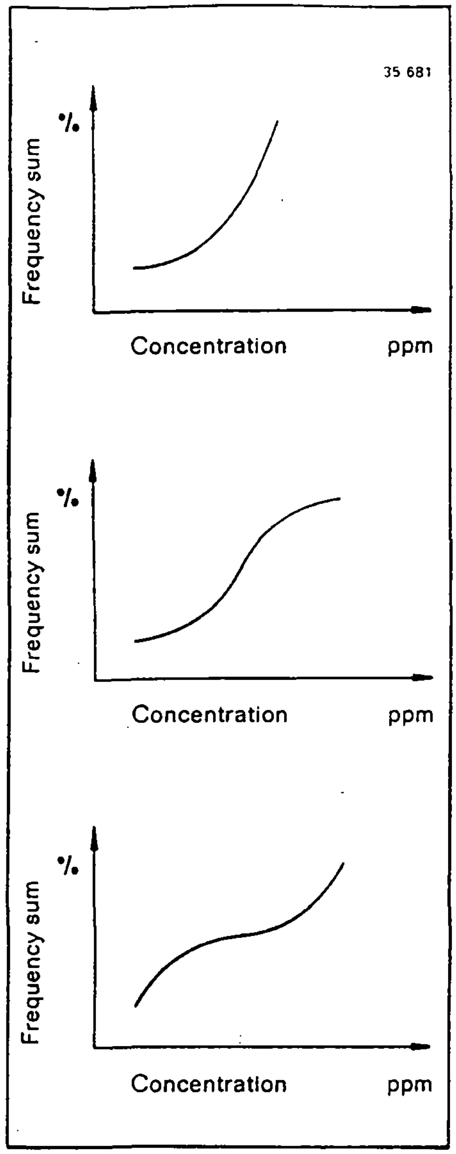
If there is a linear correlation, an estimate can be obtained from the system of coordinates as to the range within which about 68 % or about 95 % of the concentrations are to be expected.

In order to estimate the 68 % range, the points of intersection of the 16 % and 84 % horizontal lines with the curve must be associated on the abscissa with the corresponding concentrations (in our example, 68 % of the concentrations are to be expected between about 8 ppm and 45 ppm).

The 95 % range is obtained from the 2.3 % and 97.7 % horizontal lines (transferred to our example, 95 % of the concentrations are within the range from about 3 ppm to about 110 ppm).

3.2.6.3 Estimate of the median value (graphic):

The intersection of the 50 % horizontal line with the curve yields the median value of the concentrations, also called geometric mean, on the abscissa (in our example, this value is about 19 ppm).



The frequency distribution of the concentration differs from the logarithmic normal distribution (the measured values are not located on a straight line). 7

3.2.6.4 Calculation of the median value

The median value cannot only be determined graphically, but also mathematically. To this end, the logarithms of the various measured values must be picked out (table of logarithms, page 11), and the arithmetic mean of the logarithms is calculated.

Calculation of the arithmetic mean of the logarithms: $12.8205 : 10 \approx 1.282$.

By looking up the numerical value of 1.282 (table of logarithms), the result 19 ppm is obtained; this is the CO concentration corresponding to the median value which had already been obtained graphically.

Measured value	Logarithm
15 ppm	1.1761
5 ppm	0.6990
30 ppm	1.4771
7 ppm	0.8451
20 ppm	1.3010
70 ppm	1.8451
50 ppm	1.6990
30 ppm	1.4771
20 ppm	1.3010
10 ppm	1.0000
	12.8205 Sum

3.2.6.5 ***Explanation of the median value***

In specialized literature the "median" is defined as the value which halves the frequency distribution, so that each portion contains 50 % of the individual values. In the example selected by us, 50 % of the data would be above 19 ppm; and 50 % below this value.

Due to the mathematical connections, the median value of measurement results is lower than the arithmetic mean. If we were to calculate the arithmetic mean of the ten individual values of our example, we would obtain about 26 ppm. The median value provides more information for the evaluation of frequencies which correspond to the logarithmic normal distribution.

4 Aimed measurements during occurrence of concentration peaks

4.1 General remarks concerning the measuring technique

A rule-of-thumb cannot be given for these measurements. It will be necessary to observe the overall trend of the operations; if high concentrations are suspected, the measurement must be carried out immediately. Since concentration peaks usually occur for brief moments only, the measuring system used must react instantly.

4.2 Type of pump and detection of concentration fluctuations

Illustrs. 8 A–B–C demonstrate that fluctuations in the concentration are not always detected correctly even when the detector tube method is used which is known to be a rapid method.

Curve A shows the actual development of the CO concentration over a period of four minutes; it shows a fluctuation of the type which may frequently occurre under practical conditions.

The task consists in determining the average concentration for the four-minute period by means of the detector tube method.

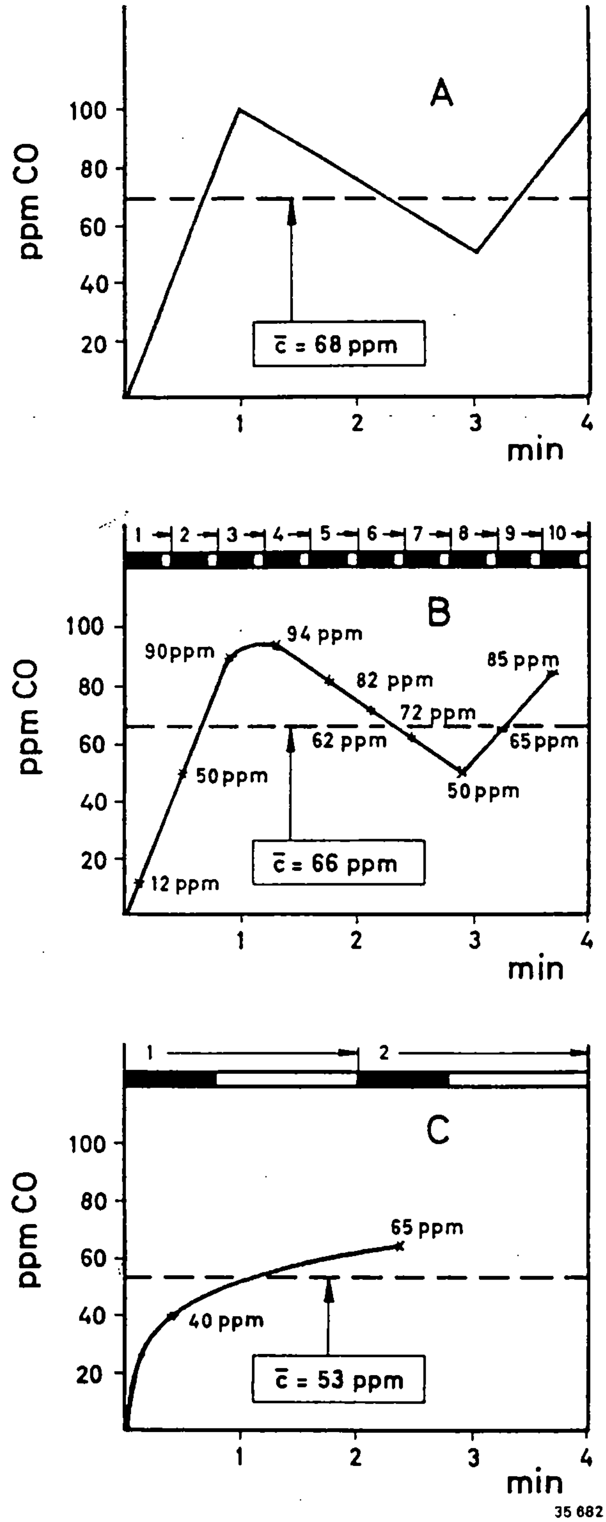
Various systems of detector tubes, differing especially with respect to the properties of the suction pumps, are available commercially. The DRÄGER bellows pump with the carbon monoxide 5/c tubes should be used for the CO measurements. When used together with these CO tubes, the bellows pump has an opening time of 15 to 25 seconds (per stroke); i. e., 100 cm^3 of the air to be analyzed are drawn through the DRÄGER CO tube during this time.

8 Ascertain of concentration fluctuations

"A" Development of the CO concentration over a period of 4 min (average Concentration $\bar{c}$ = 68 ppm).

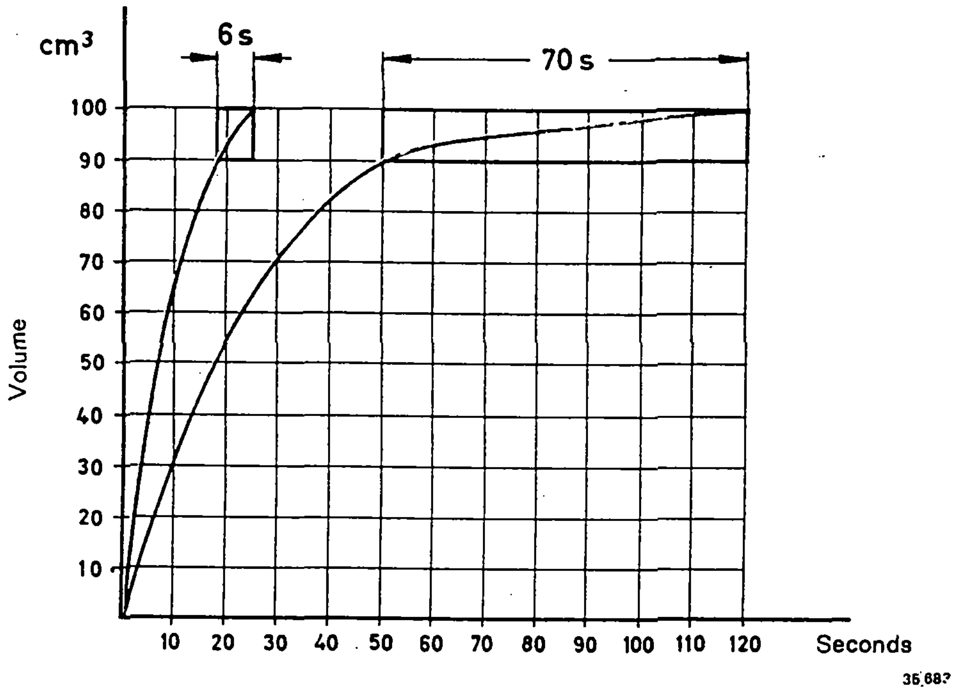
"B" Indication of the concentration if the Dräger bellows pump is used together with CO detector tubes (ten-stroke test), stroke volume of the pump 100 cm^3, opening time per stroke: 24 seconds.
Active phase of the pump (delivered volume: 90 cm^3) is 18 seconds (represented by the black area in the top portion of the system of coordinates).
Phase of low activity (volume delivered: 10 cm^3) is 6 seconds (represented by the white area in the top portion of the system of coordinates).
Result of the measurement obtained from the Dräger system. Average concentration $\bar{c}$ = 66 ppm
(set point: $\bar{c}$ = 68 ppm)

"C" Reproduction of the concentration if a piston pump is used with appropriate CO detector tube (two-stroke test), stroke volume of the pump 100 cm^3, opening time per stroke: 120 seconds.
Active phase of the pump (delivered volume: 90 cm^3) is 50 seconds (represented by the black area in the top portion of the system of coordinates).
Phase of low activity (volume delivered: 10 cm^3) ist 70 seconds (represented by the white area in the top portion of the system of coordinates).
Result of the measurement obtained from the piston pump system.
Average concentration $\bar{c}$ = 53 ppm
(set point: $\bar{c}$ = 68 ppm)



Let us discuss the piston pump system briefly. These pumps are also offered for measurements by means of detector tubes; these pumps as well deliver 100 cm³ per stroke; a period which may be more than one minute is listed as duration of the single stroke in the instructions provided by the manufacturers of these systems. In a special case which is to be discussed in greater detail, two minutes must be allowed as duration of the stroke.

This raises the question as to how the various measuring systems (detector tube + pump) available on the market measure the actual CO concentration. To this end the suction properties of the pumps must be compared to one another. The volume drawn in is shown as a function of the time in illustr. 9; the left curve refers to the DRÄGER bellows pump in combination with the CO 5/c tube, whereas the right curve was obtained from a piston pump (plus appropriate CO detector tube). For comparison the time was determined, during which the respective pump had drawn in 90 cm³, as well as the total time required for the total volume of 100 cm³.



9 **Delivery volume as a function of the time**

Left curve: Dräger bellows pump with connected CO detector tube (90 cm³ are delivered in 18 seconds, while 6 seconds are required for the remaining 10 cm³).

Right curve: piston pump with matching CO detector tube (90 cm³ are delivered in 50 seconds, while 70 seconds are required for the remaining 10 cm³).

The DRÄGER bellows pump delivers the volume of 90 cm³ within 18 seconds, with another six seconds required for the remaining 10 cm³ (the opening position of the bellows pump can be checked any time by the position of the limiter chain).

The piston pump takes 50 seconds to draw in 90 cm³, and another 70 seconds for the remaining 10 cm³ (the opening position cannot be checked in piston pumps).

In a simplified manner, it can be said that a bellows pump is "active" almost without interruption in the course of a stroke; a piston pump, on the other hand, has a rather long phase during which only a small volume is delivered. Transferred to practical conditions, there is then necessarily a difference when concentrations are measured, as shown in illustr. 8 "A" by way of example.

Illustr. 8 "B" shows the concentration curve as "seen" by the DRÄGER bellows pump in combination with the CO 5/c tubes. The various strokes from 1 to 10 have been plotted at the top of the graph. The black area corresponds to the period (18 seconds) during which 90 cm^3 are delivered. The smaller white area corresponds to the period (6 seconds) of "low delivery activity". The measurement is carried out with a total of ten strokes.

The result obtained from a piston pump (plus appropriate CO tube) is reflected in the curve shown in illustr. 8 "C". With reference to the total measurement time of four minutes, the piston pump is "active" twice for 50 seconds, while the "delivery activity" is low during a period of twice 70 seconds. The measuring system, consisting of a piston pump and CO detector tube, misses some of the CO concentration present in each case. At the end of the measurement (after four minutes), the CO tube used together with the piston pump indicates an average concentration of 53 ppm for the measuring period. As a matter of fact, the concentration is 68 ppm (illustr. 8 "A"); the indication obtained by means of the piston pump system is thus subject to a minus error of about 22 %.

The Dräger system (bellows pump + CO tube) furnishes a result of 66 ppm; with this system, the deviation from the set point is only 3 %.

This example shows the occurence of a minus error; depending on the development of the concentration, plus errors are also possible. Thus, under practical conditions, the suction properties of a pump can affect the measurement result. It appears preferable to use systems by which the measuring time interval is covered without major pauses, i. e., the active phase of the system (pump drawing in) should be long while the phase of low pump activity should be short. Only then will it be possible to detect concentration fluctuations occurring during the measurement "without gaps".

5 Air analysis at a fixed measuring point

5.1 General remarks on the measuring technique

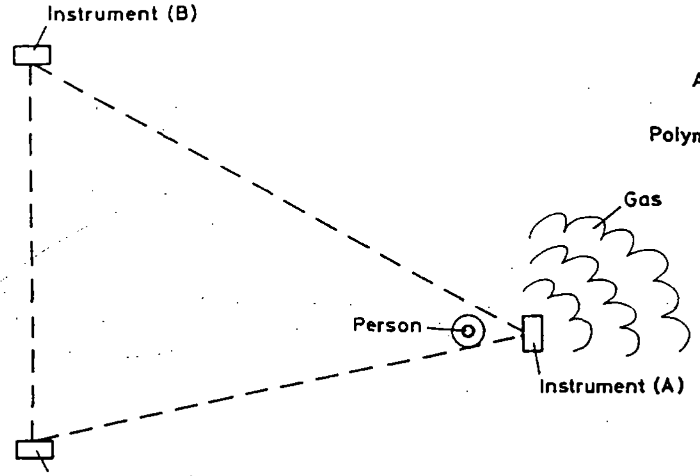
Analyses at a fixed measuring point are necessary if the concentration of toxic substances in the area of the source of the air contaminant is to be determined. Additional fixed measuring points can be set up at a specific distance from the source, so that the space distribution of the concentration can be evaluated.

5.2 Selection of the measuring points

The arrangement of three measuring points (DRÄGER Polymeter with long-term tubes) is shown in illustr. 10. A range is covered which can be represented by a triangle in simplification. It is assumed that the employee spends most of his time during the work shift mainly within this triangular area.

Another form of correlation of the measuring points is possible, but would result in a larger number of measuring points. An area can be defined clearly by three measuring points. It will, however, be necessary to check the information content of the measurement results.

Studies have shown [8] that an analysis of the air at a fixed measuring point does not always permit conclusions as to the exposure of the employee. However, it does at least permit an estimate as to the concentration range in which the person to be monitored moves; the concentration will usually be higher in the area of the source of the toxic substance than at points farther remote.



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Arrangement of three fixed measuring points (Dräger Polymeter pump with long-term detector tubes)

6 **Simultaneous use of long-term detector tubes and short-term tubes**

6.1 **General remarks on the measuring technique**

Determination of the average concentration over a period of several hours has been described in chapter 2. Long-term detector tubes are used together with the DRÄGER Polymeter to this end. If this long-term method is supplemented by the determination of the fluctuation range of the concentration by means of short-term detector tubes and DRÄGER bellows pump, as described in chapter 3, an optimum combination will probably have been found for many practical measurements.

6.2 **Arrangement of the measuring systems**

The arrangement of the two measuring systems is shown in illustr. 11. The long-term detector tube is connected to the DRÄGER Polymeter by means of the extension hose.

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Simultaneous use of long-term detector tubes and short-term detector tubes to determine the average concentration and the fluctuation range of the contentration.

11

The employee wears this system on his body throughout the measuring period (e. g., eight-hour shift). A second person actuates the bellows pump for the (ten) short-term measurements to be carried out as per section 3. The short-term detector tube is connected to the bellows pump via an extension hose. The long-term detector tubes and short-term tubes are placed in their respective tube holders. Both tube holders are located in the area of inhalation; the tube used for the long-term measurement remains there throughout the measuring period (several hours), whereas the short-term detector tube is connected only during the few minutes taken up by the short-term measurements.

Evaluation of the indications and assessment of the measurement results are handled according to sections 2 and 3.

7 Conclusion

The sample-taking schedule compiled on these pages is just a proposal. Supplementations or changes may result in practice. It will not be necessary for orientative measurements to strictly adhere to the detailed analysis programme associated with this sample-taking schedule. However, a comprehensive evaluation of the situation prevailing at the work place is possible only by systematically planning the sample-taking procedure, and the sample-taking schedule is to be an aid in this respect.

Combining the short-term detector tube method with the long-term tube method will yield a result with an high information content concerning the shift; this includes the range of fluctuation of the concentration, the actual average concentration, and the height of concentration peaks. The measuring input is low, so that the use of detector tubes can be considered to be a suitable approach in many cases; this claim is derived from the criteria: low costs of the analysis, simple manipulation, wide range of different detector tubes, immediate availability of the measurement results, and – a particularly important aspect – rapid measures to protect the employees if necessary.

TABLE 1:

Measurement time intervals from 1 to 135 (basis for one measurement: 4 min)

Hours → / Minutes ↓	1	2	3	4	5	6	7	8	9
0.00 – 0.04	1	16	31	46	61	76	91	106	121
0.04 – 0.08	2	17	32	47	62	77	92	107	122
0.08 – 0.12	3	18	33	48	63	78	93	108	123
0.12 – 0.16	4	19	34	49	64	79	94	109	124
0.16 – 0.20	5	20	35	50	65	80	95	110	125
0.20 – 0.24	6	21	36	51	66	81	96	111	126
0.24 – 0.28	7	22	37	52	67	82	97	112	127
0.28 – 0.32	8	23	38	53	68	83	98	113	128
0.32 – 0.36	9	24	39	54	69	84	99	114	129
0.36 – 0.40	10	25	40	55	70	85	100	115	130
0.40 – 0.44	11	26	41	56	71	86	101	116	131
0.44 – 0.48	12	27	42	57	72	87	102	117	132
0.48 – 0.52	13	28	43	58	73	88	103	118	133
0.52 – 0.56	14	29	44	59	74	89	104	119	134
0.56 – 0.60	15	30	45	60	75	90	105	120	135

TABLE 2:
Random numbers

Column 1	Column 2	Column 3	Column 4
64	79	81	129
55	31	20	7
106	50	134	36
103	44	102	104
123	101	64	31
78	29	29	89
117	121	98	48
68	76	78	82
83	84	6	113
27	80	88	25
72	111	100	21
120	68	111	129
110	129	67	8
21	27	58	48
75	47	12	110

TABLE 3:
Frequency sum [9] for a number of random samples from n = 5 to n = 12
(The plotting position in the probability network according to illustr. 5 is obtained from the frequency sum and the measured value.)

Number of random samples	Designation of the individual measured value											
	1	2	3	4	5	6	7	8	9	10	11	12
5	12,3	30,8	50,0	69,2	87,7							
6	10,2	26,1	42,1	57,9	73,9	89,8						
7	8,9	22,4	36,3	50,0	63,7	77,6	91,2					
8	7,8	19,8	31,9	44,0	56,0	68,1	80,2	92,2				
9	6,8	17,6	28,4	39,4	50,0	60,6	71,6	82,4	93,2			
10	6,2	15,9	25,5	35,2	45,2	54,8	64,8	74,5	84,1	93,8		
11	5,6	14,5	23,3	32,3	41,3	50,0	58,7	67,7	76,7	85,5	94,4	
12	5,2	13,1	21,5	29,5	37,8	46,0	54,0	62,2	70,5	78,5	86,9	94,9

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SECTION G:

SITE CONTROL MEASURES

G.) Site Control Measures:

This section addresses the requirement that ACS commits to a program of instituting engineering controls and work practices to reduce and maintain employee exposure to or below the permissible exposure limits of those hazardous substances regulated by 29 CFR Part 1910, Subpart Z, except to the extent that such controls and practices are not feasible. If engineering controls and work practices are not feasible, PPE shall be used to protect employees until adapted control measures can be implemented or as a permanent requirement to reduce exposure to below established permissible exposure limits. Employee rotation will not be used as a means of compliance with permissible exposure limits.

The basis for determining site control measures will be the results of the Air Monitoring Program and Task Risk Analysis both are scheduled for 1 September 1987. The results will be analyzed by the Site Safety and Health Officer, the ACS Safety Committee and the management of ACS. At this time without knowing the extent of the exposure levels, the following site control measures are being considered:

1.) No action- exposure levels are within standards guidelines but regular air monitoring will continue.

2.) Limited action:
  - A.) Increase air circulation.
  - B.) Limit time requirements in areas of high exposure.
  - C.) Minor equipment and/or process alterations to reduce emissions.
  - D.) Mandatory PPE requirements when stationary analyzers indicate by alarm above permitted exposure levels.
  - E.) TO BE DETERMINED

3.) Major action:
  - A.) Complete removal of the employee from areas of high exposure (Remote operations).
  - B.) Major equipment and/or process alterations to reduce emissions.
  - C.) Mandatory PPE requirement whenever a person is working in an area of high exposure and control measures are not feasible.
  - D.) TO BE DETERMINED

When an adopted control measure has been selected, for an area which has high exposure levels, a schedule for completion will be determined. The schedule and a description of the control measure will be attached to the Task Risk Analysis.

SECTION H:

DECONTAMINATION PROCEDURES

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H.)

Topic: Decontamination Procedures

Date: August 1988

The activities conducted at ACS which may require decontamination procedures are as follows:

1. Ordinary operations:
   A. Unloader emptying drums and pumping material through the straining bin. Decontaminate protective clothing and respirator.
   B. Loading or unloading any hazardous material requiring protective clothing and/or a respirator.
2. Scheduled Corrective Action:
   A. Laborer digs solids which collect in stills and storage tanks. This procedure is covered under the Hazardous Atmosphere Entry Program.
3. Emergency Response:
   A. Rescue, this procedure is covered under the Hazardous Atmosphere Entry Program.
   B. Minor and Major Spill Response.
   C. Fire or explosion causing a toxic gas or a spill release.

The activities required during responses to incidents or assigned work activities involving hazardous substances may contribute to the unwanted movement of contaminants from the site to uncontaminated areas. Response or assigned personnel and equipment may become contaminated and transfer the material into clean areas. Material may become airborne due to its volatility or the disturbance of contaminated soil may cause it to become windblown. To minimize the transfer of hazardous substances from the site, contamination control procedures are needed. Two general methods are used: establishing site work zones and removing contaminants from people and equipment.

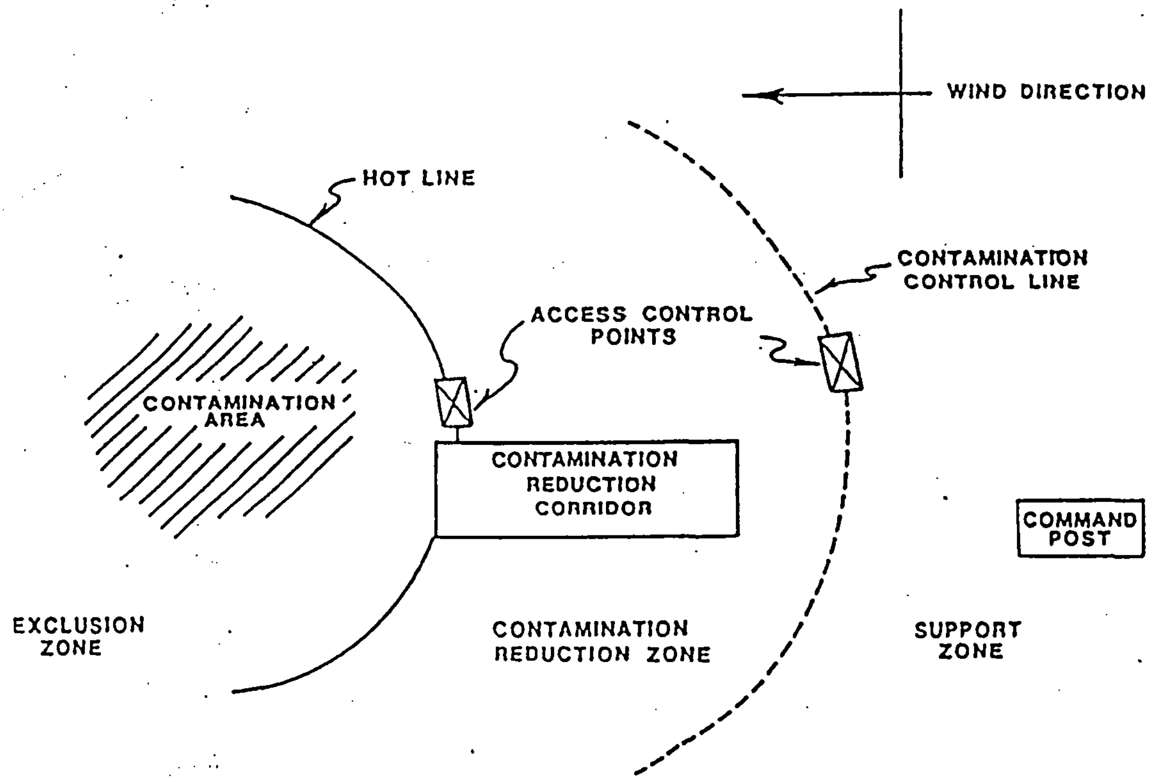


DIAGRAM OF SITE WORK ZONES

FIGURE 1

PRELIMINARY ON-SITE EVALUATION

The initial on-site survey is to determine, on a preliminary basis, hazardous or potentially hazardous conditions. The main effort is to rapidly identify the immediate hazards that may affect the public, response personnel, and the environment. Of major concern are the real or potential dangers from, fire, explosion, airborne contaminants and to a lesser degree radiation and oxygen deficient atmospheres.

A. Organic Vapors and Gases

If the type of organic substance involved in an incident is known and the material is volatile or can become airborne, air measurements for organics should be made with one or more appropriate, properly calibrated survey instruments.

B. Oxygen Deficiency

Normal air contains about 20.5% by volume of oxygen. At or below 19.5% oxygen air-supplied respiratory protective equipment is needed. Oxygen measurements are of particular importance for work in enclosed spaces, low-lying areas, or in the vicinity of accidents that have produced heavier-than-air vapors which could displace ambient air. These oxygen deficient areas are also prime locations for taking further organic vapor and combustible gas measurements, since the air has been displaced by other substances. Oxygen-enriched atmospheres increase the potential for fires.

Combustible Gases

The presence or absence of combustible vapors or gases must be determined. If readings approach or exceed 10% of the lower explosive limit (LEL), extreme caution should be exercised in continuing the investigation. If readings approach or exceed 25% LEL, personnel should be withdrawn immediately. Before resuming any on-site activities, project personnel in consultation with experts in fire or explosion prevention must develop procedures for continuing operations.

ATMOSPHERIC HAZARD GUIDELINES

Monitoring Equipment	Hazard	Ambient Level	Action
Combustible gas indicator	Explosive atmosphere	10% LEL	Continue investigation with cautions.
		10%-25%	Continue on-site monitoring with extreme caution as higher levels are encountered.
		25% LEL	Explosion hazard; withdraw from area immediately.
Oxygen concentration meter	Oxygen	19.5%	Monitor wearing SCBA. <u>NOTE</u>: Combustible gas readings are not valid in atmospheres with 19.5% oxygen.
		19.5%-25%	Continue investigation with caution. SCBA not needed, based on oxygen content only.
		25.0%	Discontinue inspection fire hazard potential. Consult specialist.

Control at the Site:

A site must be controlled to reduce the possibility of: 1) contact with any contaminants present and 2) removal of contaminants by personnel or equipment leaving the site. The possibility of exposure or translocation of substances can be reduced or eliminated in a number of ways, including:

- Setting up security and physical barriers to exclude unnecessary personnel from the general area.
- Minimizing the number of personnel and equipment on-site consistent with effective operations.
- Establishing work zones within the site.
- Establishing control points to regulate access to work zones.
- Conducting operations in a manner to reduce the exposure of personnel and equipment and to eliminate the potential for airborne dispersion.
- Implementing appropriate decontamination procedures.

Work Zones

One method of preventing or reducing the migration of contaminants is to delineate zones on the site in which prescribed operations occur. Movement of personnel and equipment between zones and onto the site itself would be limited by access control points. By these means, three contiguous zones (Figure 1) are recommended:

Zone 1: Exclusion Zone

Zone 2: Contamination Reduction Zone

Zone 3: Support Zone

Exclusion Zone

The Exclusion Zone, the innermost of the three areas, is the zone where contamination does or could occur. All people entering the Exclusion Zone must wear prescribed Levels of Protection. An entry and exit check point must be established at the periphery of the Exclusion Zone to regulate the flow of personnel and equipment into and out of the zone and to verify that the procedures established to enter and exit are followed.

The outer boundary of Zone 1, the Hotline, is initially established by visually surveying the immediate environs of the incident and determining where the hazardous substances involved are located; where any drainage, leahate, or spilled material is; and whether any discolorations are visible. Guidance in determining the boundaries is also provided by data from the initial site survey indicating the presence of organic or inorganic vapors/ gases or particulates in air and combustible gases.

Additional factors that should be considered include the distances needed to prevent fire or an explosion from affecting personnel outside the zone, the physical area necessary to conduct site operations, and the potential for contaminants to be blown from the area. Once the Hotline has been determined it should be physically secured, fenced, or well-defined by landmarks. During subsequent site operations, the boundary may be modified and adjusted as more information becomes available.

All personnel within the Exclusion Zone must wear the required Level of Protection. Personnel protective equipment is designated based on site-specific conditions including the type of work to be done and the hazards that might be encountered. Frequently within the Exclusion Zone, different Levels of Protection are justified. The Level of Protection is determined by the measured concentration of substances in air, potential for contamination, and the known or suspected presence of highly toxic substances.

Different Levels of Protection in the Exclusion Zone might also be designated by job assignment. For example, collecting samples from open containers might require Level B protection, while for walk-through ambient air monitoring, Level C protection might be sufficient. The assignment, when appropriate, of different Levels of Protection within the Exclusion Zone generally makes for a more flexible, effective, and less costly operation while still maintaining a high degree of safety.

Support Zone

The Support Zone, the outermost part of the site, is considered a noncontaminated or clean area. Support equipment (command post, equipment trailer, etc.) is located in the zone; traffic is restricted to authorized response or assigned personnel. Since normal work clothes are appropriate within this zone, potentially contaminated personnel clothing, equipment, and samples are not permitted, but are left in the Contamination Reduction Zone until they are decontaminated.

Contamination Reduction Zone

Between the Exclusion Zone and the Support Zone is the Contamination Reduction Zone which provides a transition between contaminated and clean zones. Zone 2 serves as a buffer to further reduce the probability of the clean zone becoming contaminated or being affected by other existing hazards. It provides additional assurance that the physical transfer of contaminating substances on people, equipment, or in the air is limited through a combination of decontamination, distance between Exclusion and Support Zones, air dilution, zone restrictions, and work functions.

Initially, the Contamination Reduction Zone is considered to be a noncontaminated area. At the boundary between the Exclusion and Contamination Reduction Zones, Contamination Reduction Corridors (decontamination stations) are established, one for personnel and one for heavy equipment. Depending on the size of the operation, more than two corridors may be necessary. Exit from the Exclusion Zone is through a Contamination Reduction Corridor. As operations proceed, the area around the decontamination station may become contaminated, but to a much lesser degree than the Exclusion Zone. On a relative basis, the amount of contaminants should decrease from the Hotline to the Support Zone due to the substance involved and the decontamination procedures used.

The boundary between the Support Zone and the Contamination Reduction Zone, the Contamination Control Line, separates the possibly low contamination area from the clean Support Zone. Access to the Contamination Reduction Zone from the Support Zone is through a control point. Personnel entering there would wear prescribed personnel protective equipment, if required, for working in the Contamination Reduction Zone. Entering the Support Zone requires removal of any protective equipment worn in the Contamination Reduction Zone.

Modifications

The use of a three-zone system, access control points, and exacting decontamination procedures provides a reasonable assurance against the translocation of contaminating substances. This site control system is based on a worst case situation. Less stringent site control and decontamination procedures may be utilized if more definitive information is available on the types of substances involved and hazards they present. This information can be obtained through air monitoring, instrument survey and sampling, and technical data concerning the characteristics and behavior of material present.

Area Dimensions

The distance between the Hotline, Contamination Control Line, and command post and the size and shape of each zone have to be based on conditions specific to each site. Considerable judgement is needed to assure that the distances between zone boundaries are large enough to allow room for the necessary operations, provide adequate distances to prevent the spread of contaminants, and eliminate the possibility of injury due to explosion or fire. Long-term operations would involve developing reasonable methods (for example, air surveillance, swipe testing, and visible deterioration) to determine if material is being transferred between zones and to assist in modifying site boundaries.

The following criteria should be considered in establishimg area dimensions and boundaries:

- Physical and topographical features of the site.
- Weather conditions.
- Field/laboratory measurements of air contaminants and environmental samples.
- Air dispersion calculations.
- Potential for explosion and flying debris.
- Physical, chemical, toxicoligical, and other characteristics of the substances present.
- Cleanup activities required.
- Potential for fire.
- Area needed to conduct operations.
- Decontamination procedures.
- Potential for exposure.
- Proximity to residential or industrial areas.

Monitoring and sampling

To verify that site control procedures are preventing the spread of contamination, a monitoring and sample program should be established. The Support Zone should be periodically monitored for air contaminants using direct-reading instruments and collecting air samples for particulate, gas, or vapor analysis.

Decontamination:

Personnel responding or work practices handling hazardous substances may become contaminated in a number of ways including:

- Contacting vapors, gases, mists, or particulates in the air.

- Being splashed by materials while sampling or opening containers.

- Walking through puddles of liquids or on contaminated soil.

- Using contaminated instruments or equipment.

Protective clothing and respirators help prevent the wearer from becoming contaminated or inhaling contaminants; while good work practices help reduce contamination on protective clothing, instruments, and equipment.

Even with these safeguards, contamination may occur. Harmful materials can be transferred into clean areas, exposing unprotected personnel. In removing contaminated clothing, personnel may contact contaminants on the clothing or inhale them. To prevent such occurrences, methods to reduce contamination, and decontamination procedures must be developed and established before anyone enters a site and must continue (modified when necessary) throughout site operations.

Decontamination consists of physically removing contaminants or changing their chemical nature to innocuous substances. How extensive decontamination must be depends on a number of factors, the most important being the type of contaminants involved. The more harmful the contaminant, the more extensive and thorough decontamination must be. Less harmful contaminants may require less decontamination.

Combining decontamination, the correct method of doffing personnel protective equipment, and the use of site work zones minimizes cross- contamination from protective clothing to wearer, equipment to personnel, and one area to another. Only general guidance can be given on methods and techniques for decontamination. The exact procedure to use must be determined after evaluating a number of factors specific to the incident.

Initial Planning

The initial decontamination plan assumes all personnel and equipment leaving the Exclusion Zone (area of potential contamination) are grossly contaminated. A system is then set up for personnel decontamination to wash and rinse, at least once, all the protective equipment worn. This is done in combination with a sequential doffing of protective equipment, starting at the first station with the most heavily contaminated item and progressing to the last station with the least contaminated article. Each step of the procedure requires a separate station.

The initial decontamination plan is based on a worst-case situation or assumes no information is available about the incident. Specific conditions at the site are then evaluated, including:

- Type of contaminant.
- The amount of contamination.
- Levels of protection required.
- Type of protective clothing worn.

The initial decontamination plan is modified, eliminating unnecessary stations or otherwise adapting it to site conditions. For instance, the initial plan might require a complete wash and rinse of chemical protective garments. If disposable garments are worn, the wash/rinse step could be omitted. Wearing disposable boot covers and gloves could eliminate washing and rinsing these items and reduce the number of stations needed.

Establishment of Procedures

Once decontamination procedures have been established, all personnel requiring decontamination must be given precise instructions (and practice, if necessary). Compliance must be frequently checked. The time it takes for decontamination must be ascertained. Personnel wearing SCBA's must leave their work area with sufficient air to walk to CRC and go through decontamination.

The decontaminating procedures for the operations conducted at ACS are as follows:

1. Ordinary operations:
   A. Unloader emptying drums and pumping material through the straining bin. This is a Level C decontamination.
      a.) Deposit all manual equipment used (shovels, etc.) in drum unloading dock.
      b.) Remove any solids from the equipment and protective clothing and put solids in a solid hazardous waste container.
      c.) Remove outer gloves.
      d.) Remove the protective suit by rolling inside out and downward and deposit in the proper container. If splashed on by hazardous waste, the suit will be deposited in a solid hazardous waste container. If not splashed on, the suit will be deposited in the general refuse container.
      e.) Remove inner gloves.
      f.) Remove the respirator, disinfect, wipe clean and replace cartridges if the senses detected any abnormal condition during the usage.
      g.) Store the respirator in the proper cabinet in Location A, after inspecting the respirator for worn or faulty parts.
      h.) Wash hands and face thoroughly in the changeroom facility before eating or drinking.
   B. Loading or unloading any hazardous material requiring protective clothing and/or a respirator. This is a Level C decontamination. Same as 1.A except disregard a.

2. Scheduled Corrective Action:
   Laborer digs solids which collect in stills and storage tanks. This is a Level B decontamination and is outlined in the Hazardous Atmosphere Entry Program.

   Decontamination procedure after the completion of the hazardous atmosphere entry:

   1.) Deposit equipment (shovels, rakes, etc.) used at the location of the operation.
   2.) Clean off equipment and put contaminated solids into the selected hazardous waste containers.
   3.) Clean off boots, outer gloves and protective suit and put contaminated solids into the selected hazardous waste containers.
   4.) Close the hazardous waste containersand move to the Contamination Reduction Zone.

5.) Remove the protective boots and the outer gloves.
6.) Remove the protective suit by rolling inside out and downward and the inner gloves and deposit in the proper container.
7.) Remove the air supply mask.
8.) Wash hands and face thoroughly utilizing the face washing station or the pressurized spray nozzle located in the collection tub and move to the Support Zone.
9.) The liquid in the collection tub will be pumped with a poly hand pump into a hazardous waste container by the decontamination personnel.

3. Emergency Response:
   A. Rescue. This is an undeterminable level decontamination and therefore will be addressed as a Level B decontamination. The outline is covered in the Hazardous Atmosphere Entry Program.
   B. Minor and major spill response. This decontamination will be either a Level C or Level B. Level C will require a protective suit and a respirator and Level B will require a protective suit and an air supply system. For a Level C decontamination the procedure will be as follows:
      a.) Deposit all manual equipment (shovels, rakes, etc.) in the work areas.
      b.) Clean all solids from the equipment and the protective suit. Put solids into a hazardous waste solids container.
      c.) Close all hazardous waste solids containers used during the spill response and move to the Contamination Reduction Zone.
      d.) Remove the protective boots and the outer gloves.
      e.) Remove the protective suit by rolling inside out and downward and the inner gloves and deposit in a hazardous waste container.
      f.) Remove the respirator, disinfect, wipe clean and replace cartridges if the senses detected any abnormal condition during the usage.
      g.) Store the respirator in an approved location after inspecting the respirator for worn or faulty parts.
      h.) Wash hands and face thoroughly utilizing the face washing station or the pressurized spray nozzle located in the collection tub and move to the Support Zone.
      i.) The liquid in the collection tub will be pumped with a poly hand pump into a hazardous waste container by the decontamination personnel.

      For a Level B decontamination the procedure will be the same as outlined in the Hazardous Atmosphere Entry Program.
   C. Fire or explosion causing a toxic gas or spill release same as 3.

Protection for Decontamination Workers

The Level of Protection worn by decontamination workers is determined by the Site Safety and Health Officer taking into account:

Expected or visible contamination on workers.

- Type of contaminant and associated respiratory and skin hazards.

- Total vapor/gas concentrations in the contamination reduction corridor.

- Particulates and specific inorganic or organic vapors in the Contamination Reduction Zone.

The decontamination procedures will be monitored by the Site Safety and Health Officer to determine their effectiveness. If the procedures are proven ineffective, action will be taken to correct the deficiencies. The Site Safety and Health Officer observes each employee performing decontamination as outlined. If he observes any improper procedures he notifies the supervisor in charge to instruct the employee about proper procedure. He also periodically asks the employee what his decontamination procedures are involving hazardous substances. The employee must reply with the proper procedure. If the Site Safety and Health Officer becomes aware of a misunderstanding or complacency concerning the decontamination procedures, he will notify the management and more mandatory training will be scheduled.

If an employee is involved in an incident in which non-impermeable clothing becomes wetted with a hazardous substance, the clothing will be immediately moved in that area. The employee will be taken to a safety shower and thoroughly washed. The clothing will be decontaminated in that area before removal.

All protective clothing and protective equipment are stored in designated areas and are part of the daily inspection schedule.

SAFETY PRACTICES

Personal Precautions:

- Eating, drinking, chewing gum or tobacco, smoking or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in any area designated contaminated.

- Hands and face must be thoroughly washed upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body should be thoroughly washed as soon as possible after the protective garment is removed.

- No facial hair which interferes with a satisfactory fit of the mask-to-face-seal is allowed on personnel required to wear respirators.

- Contact with contaminated or suspected contaminated surfaces should be avoided. Whenever possible, do not walk through puddles, leachate, discolored surfaces, kneel on ground, lean, sit, or place equipment on drums, containers, or the ground.

- Medicine and alcohol can potentiate the effects from exposure to toxic chemicals. Prescribed drugs should not be taken by personnel on response operations where the potential for absorption, inhalation, or ingestion of toxic substances exists unless specifically approved by a qualified physician. Alcoholic beverage intake should be minimized or avoided during response operations.

- All personnel going on-site must be adequately trained and thoroughly briefed on anticipated hazards, equipment to be worn, safety practices to be followed, emergency procedures, and communications.

- Any required respiratory protective devices and clothing must be worn by all personnel going into areas designated for wearing protective equipment.

- Personnel on-site must use the buddy system when wearing respiratory protective equipment. As a minimum, a third person, suitably equipped as a safety backup, is required during initial entries.

- Visual contact must be maintained between pairs on-site and safety personnel. Entry team members should remain close together to assist each other during emergencies.

- During continual operations, on-site workers act as safety backup to each other. Off-site personnel provide emergency assistance.

- Personnel should practice unfamiliar operations prior to doing the actual procedure.

- Entrance and exit locations must be designated and emergency escape routes delineated. Warning signals for site evacuation must be established.

- Communications using radios, hand signals, signs, or other means must be maintained between initial entry members at all times. Emergency communications should be prearranged in case of radio failure, necessity for evacuation of site, or other reasons.

- Personnel and equipment in the contaminated area should be minimized consistent with effective site operations.

- Work areas for various operational activities must be established.

- Procedures for leaving a contaminated area must be planned and implemented prior to going on-site. Work areas and decontamination procedures must be established based on expected site conditions.

Indicators of Toxic Exposure Effects

- Observeable by others
  - changes in complexion, skin discoloration
  - lack of coordination
  - changes in demeanor
  - excessive salivation, pupillary response
  - changes in speech pattern
- Non-Observeable by others
  - headaches
  - dizziness
  - blurred vision
  - cramps
  - irritation of eyes, skin, or respiratory tract

SECTION I:

STANDARD OPERATING PROCEDURES

I.) Standard Operating Procedures:

This section addresses the requirement to outline and describe in detail the routine procedures conducted under each job title mentioned in Section B. In the following pages is a detailed description of the procedures for each job title. This information is an excerpt of the ACS RCRA Part B.

Job descriptions Outlining the Methods for Handling Hazardous Wastes

Job titles related to hazardous wastes are as follows:

1) Operator

2) Unloader

3) Loader

4) Tractor driver

5) Laborer

Written job descriptions for each position are as follows:

1) Operator

Operators operate the reclaim facility. They distill solvents from hazardous wastes in Location B (See Figure 1) in vessels (stills) using steam and vacuum. The distillate solvents are stored in the reclaim product tank farm. The residues from the stills are pumped to the waste fuel tank farm at Location C (See Figure 1).

Routine Procedures are as follows:

a) Charge amounts of 4000 and 2300 gallons.

b) Pumping hazardous waste from tanks in Location B to the still.

c) Still startup.

d) Distillation of solvents during run.

e) Sampling of residue to shutdown still.

f) Shutdown of still.

g) Pumping residue to Location C.

h) Digging still heating coils.

i) Distillation of solvents in #7 still.

Detailed procedures for steps (a) through (i) are attached.

a) The charge amounts are 4000 and 2300 gallons. Below is a list of the storage tanks and the inches on the straight side of each tank which corresponds to the designed charge.

TANK	4000 GAL.	2300 GAL.	GAL/INCH
116-119	57 inches	33 inches	70.5
120	100 "	58 "	40.
121-122	82 "	47 "	48.5
123-126	82 "	47 "	48.5
1A-1B		111"	20.7

The gauges on the tanks are counterweight float type. When the counter weight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty.

Figure 2 shows the location of the storage tanks.

b) Pumping hazardous waste from tanks in Location B to the still. Charges for the stills are contained in tanks 1A, 1B, 116-119, 120-126. Figures 2 and 3 are detailed drawings showing the tanks, piping, and valves. The procedure for charging a still from the storage tank is as follows:

1) The supervisor specifies the material to be charged; the amount, and the storage tank number. This information is written on a daily run sheet for each still.
2) The operator determines the inches corresponding to the specified gallons from the tank chart in part (a).
3) The operator, wearing an emergency belt (personnel alarm, eyewash and respirator), checks that the still is empty by opening the atmospheric vent valve on the still and then opening a drain valve on the bottom of the still. He drains the line into a bucket.
4) The operator turns on the still recirculating pump.
5) The operator opens valves on the transfer line between the storage tank and the still. He closes unused valves attached to the transfer line. The last valve to be opened is the storage tank valve.
6) The operator sets the pin on the 0 inches mark on the tank.
7) The operator opens the valve on the storage tank.
8) The operator turns on the transfer pump to pump material to the still.
9) The operator inspects the lines to check that the line has no leaks.
10) The operator watches the pin move on the storage tank to make sure that the material is being pumped from the proper tank.
11) The operator periodically checks the line to make sure it is not leaking.
12) The operator remains in the area while pumping to the still.
13) The operator closes the storage tank valve when the pin reaches the proper inches reading on the gauge.
14) The operator turns off the pump.
15) The operator closes all valves on line between the storage tank and the still.
16) The operator enters the time, storage tank number, still number, and gallons charged on the standard still run sheet.

c) Still startup
Stills are run at atmospheric or vacuum conditions. At the atmospheric condition the startup procedure is as follows:

1) The operator checks that the atmospheric vent valve on the still is open.
2) The operator sets the vent float in case the still later bumps during heatup. This device prevents the contents of the still from foaming out of the still during the run.
3) The operator closes the valve on the vacuum line to the still.
4) The operator records the time and temperature of the pot, vapor, and the cooling water on the condenser outlet.
5) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig usually. Runs of crude methylene chloride, perchlor, and trichlor require initial pressure settings of 30 psig.
6) The operator monitors the still pot temperature. At 120-150F solvents usually begin to vaporize from crude in the still. The vapors pass to the condenser where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still.
7) The operator turns on the product pump when the distilled solvent first appears in the sight glass. The pump, which can pump 1/2 to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.
8) The operator records the time and temperature when the still starts to distill.

At the vacuum condition the startup procedure is as follows:

1) The operator closes the atmospheric vent valve on the still.
2) The operator opens the valve on the vacuum line to the still.
3) The operator sets the vacuum controls on 30(no vacuum).
4) The operator turns on the vacuum pump and sets the seal water flow at 5 gallons per minute or 5 psig on gauge.
5) The operator slowly adjusts the vacuum controller to a setting of 15.
6) The operator records the time and temperatures of the pot, vapor, and cooling water on the condenser outlet.
7) The operator opens the steam valve to the still heating coil and sets the steam regulator to 40 psig.
8) The operator monitors the still pot temperature. At 110-130F solvents usually begin to vaporize from the crude in the still. The vapors pass to the condenser where they cool and become a liquid which then appears flowing in the sight glass above the product pump on each still. If the material in the sight glass is dirty, the operator turns off the steam to the heating coil and sets the vacuum controller to 30. He opens the atmospheric vent on the still after hooking up the nitrogen purge system to the vent.

A check valve on the nitrogen purge system will clatter when the atmospheric condition is reached. The operator removes the nitrogen purge system and goes back to step (1) and starts over again. Any dirty material in the lines is drummed.

9) The operator turns on the product pump when clean distilled solvent first appears in the sight glass. The pump, which can pump 1/2 to 5 gallons per minute automatically, transfers the liquid to a 1000 gallon receiver.

10) The operator records the time and temperature when the still starts to distill.

d) Distillation of solvents during run.
During the run the operator watches the sight glass and vacuum indicator. Every other hour the time, vacuum, and temperatures of the vapor, pot, and condenser outlet water are entered on the run sheet. When a receiver almost fills, the operator takes a sample to check for color before pumping the liquid in the receiver. He then pumps it to a storage tank specified by the supervisor. The operator enters the time, storage tank gauge readings, before and after pumping, and the corresponding gallons. The gallons are then subtracted from the total initial charge to the still. The remaining gallons in the still are entered on the still run sheet.

e) Sampling of residue to shutdown still.
As solvents is distilled the residues is concentrated and its viscosity or thickness increases. The operator takes a 4 ounces sample from a sample valve on the still coil when approximately 40-50% of the charge volume is distilled. When the sample cools and its consistency is like molasses, the still is shutdown.

Operator - Routine procedures

f) Shutdown of still
The shutdown procedure for a still under vacuum conditions is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the vacuum pump and seal water.
4) The operator attaches the nitrogen purge system to the atmospheric still vent line.
5) The operator opens the still vent valve.
6) The operator opens the nitrogen valve and sets the rotameter at 30 to bring the still back to atmospheric pressure. A check valve on the purge system clatters when atmospheric pressure is reached.
7) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
8) The operator leaves the still recirculating pump on during and after the shutdown.

The shutdown procedure for a still at the atmospheric condition is as follows:

1) The operator enters the gallons remaining in the still and the time of the shutdown on the run sheet.
2) The operator closes the steam valve to the still heating coil.
3) The operator turns off the product pump when the flow in the sight glass is reduced to a trickle.
4) The operator leaves the still recirculating pump on during and after the shutdown.

g) Pumping residue to Location C.
Residues are pumped from the stills with a residue pump to storage tanks at Location C. Figure 3 shows the stills and pump, and Figure 4 shows the storage tanks at Location C. The procedure for pumping the residue is as follows:

1) The supervisor specifies the proper storage tank at Location C. This information is written on a daily run sheet for each still.
2) The operator, wearing the emergency belt, determines the inches corresponding to the gallons of residue in the still for the specified storage tank.
See table below.

Tanks - 202,203 204,205,206 Gallons Residue	Inches	Tanks 210 211,212 Gallons Residue
540	10"	700
810	15"	1050
1080	20"	1400
1350	25"	1750
1620	30"	2100
1890	35"	2450
2160	40"	2800
2430	45"	3150
2700	50"	3500

3) The operator then measures the void space in inches in the storage tank at Location C to check if the tank will hold the gallons of residue figured in tank inches.
4) The operator sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The operator checks the tank overfill alarm.
6) The operator opens the valve on the storage tank.
7) The operator walks the line from the storage tank to the residue pump opening the proper valves and closing unused valves attached to the line.
8) The operator opens the bottom valve on the still.
9) The operator turns on the residue pump.
10) The operator loosely touches the line until it warms.
11) The operator walks the residue line to the storage tank to check for leaks.
12) The operator watches the pin move on the guage at the storage tank to check that the residue is being pumped to the proper tank.
13) The operator periodically checks the residue line to make sure that no one has changed the valve settings and that the line is not leaking.
14) The operator remains in the area during the pumping of the residue.
15) The residue pump changes pitch when the still goes empty. The operator then closes the bottom valve on the still and discharge valve on the pump.
16) The operator turns off the pump.
17) The operator checks that the still is empty by opening a drain valve on the bottom of the still and draining the line into a bucket.

18) The operator closes the valve on the storage tank at Location C.

19) The operator closes all valves on the lines between the storage tank and the still.

20) The operator enters the time, storage tank, and gallons pumped from the inches on the gauge on the still run sheet.

h) Digging still heating coils

The procedures for digging the still heating coils is as follows:

1) The operator closes the 3 inch inlet recirculating valve to the coils.
2) The operator connects a nitrogen hose to the south end of the coil and blows any material left in the coil back into the still.
3) The operator closes the 3 inch outlet recirculating valve on the coils.
4) The operator drains any material remaining in the coil through a sample valve at the north end of the coil.
5) The operator removes the bolts on the coil flange.
6) The operator slowly pulls out the coil from the recirculating line to a support stand until he sees the end of the coil. Any excess material on the coils drains into trough on the north end of the coil.
7) The operator scrapes the coil with a curved spade until bare metal is seen.
8) The operator inserts the coil back into recirculating line and attaches the bolts to the flange.
9) The operator cleans 4 coils in #1 and #2 and 2 coils on #3 still.
10) The operator enters that the coils were dug on the still run sheet.

i) Distillation of Solvents in #7 still.

#7 still is a stainless steel 6000 gallon still fitted with a fractionating column and receiver. Solvents are fractionated or separated by liquids flowing down the column while vapors flow up the column from the still. Liquid flow down the column is controlled with a rotameter and pump which pumps liquid from the receiver. The liquid level in the receiver is held constant by adjusting a rotameter on the line to the storage tank.

The still runs at atmospheric pressure but is rated for full vacuum. Typical charges for the still are 5000 gallons. Routine procedures for charging and still startup are identical to the other three stills running at atmospheric pressure except #7 still has no recirculating pump.

During the run the operator maintains constant reflux rate to the top of the column and varies the takeoff rate from the receiver to the storage tank to maintain a constant level in the receiver. He records pot and vapor temperatures, reflux rate, and takeoff rate every other hour.

The supervisor instructs the operator when to shutdown the still. The operator then turns off the steam to the heating jacket and the reflux pump. The operator pumps the residue to a tank designated by the supervisor.

2) Unloaders - Location A,B and C

Unloaders pump hazardous waste from tank wagons at unloading ramps in Location B and C. (See Figure 1) to storage tanks. They also unload drums of hazardous waste from box trailers to Location A (See Figure 1) and pump their contents to storage tanks in Location B or C.

Routine procedures are as follows:

a) Unloading tank wagons of hazardous waste.

b) Unloading box trailers of hazardous waste at Location A.

c) Pumping hazardous waste in drums at Location A to storage tanks.

d) Charging viscous liquids in drums to small blending tank at Location A.

e) Pumping liquids in small blending tank at Location A to storage tanks at Location C.

Detailed procedures for steps (a) through (e) are attached.

Unloader - Routine

a) Unloading tank wagons of hazardous waste

Hazardous waste is pumped from tank wagons at unloading ramps at Location B and C to storage tanks 1A,1B,116-126. Figures 1,2,4 show the location, pumps, piping and valves for each tank. The gauges on the storage tanks are counter-weight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 1 shows the gallons of void space and corresponding inches on the straight side of each tank. The procedure for unloading tank wagons is as follows:

1) The supervisor checks the manifest papers.
2) The unloader, wearing a protective suit and emergency belt, vents the tank wagon.
3) The unloader opens the manway.
4) The unloader lowers a sample container to the bottom of the tank wagon.
5) The unloader brings the sample to the lab. When the supervisor analyzes the sample, he instructs the unloader to unload the tank wagon to a specified storage tank.
6) The unloader measures the void space inches in the storage tank to check if the tank will hold the gallons in the tank wagon (See Table 1).
7) The unloader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
8) The unloader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
9) The unloader connects the unloading hose to the tank wagon.
10) The unloader walks the line from the tank wagon to the storage tank, opening the proper valves and closing unused valves attached to the line.
11) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
12) The unloader checks the tank overfill alarm.
13) The unloader opens the valve on the storage tank.
14) The unloader turns on the unloading pump.
15) The unloader slowly opens the bottom valve on the tank wagon. He feels the 3 inch unloading hose become heavy with material.
16) The unloader looks into the top of the tank wagon to check that the material is being pumped from the tank wagon.
17) The unloader walks the line to the storage tank to check for leaks.
18) The unloader watches the pin move on the gauge at the storage tank to check that the material is being pumped to the proper tank.
19) The unloader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.

20) The unloader remains in the area during the pumping of the material.
21) The unloader watches the tank wagon go empty and then closes the bottom valve on the tank wagon.
22) The unloader turns off the pump and immediately closes the discharge valve on the pump.
23) The unloader closes the valve on the storage tank first and then closes valves on the transfer line.
24) The unloader removes the unloading hose slowly from the tank wagons.
25) The unloader disconnects the grounding device and removes the chocks.
26) The unloader signs the manifest papers with the supervisor's approval and returns them to the driver. He also informs the driver that all valves are closed and hoses are disconnected.
27) If the filter on the suction side of the transfer pump should plug during unloading, the following steps are taken:

i) The unloader closes the valve on the suction side of the filter.
ii) The unloader turns off the transfer pump.
iii) The unloader opens the nitrogen valve on the top of the filter to blow material out of the filter.
iv) The unloader closes the valve on the nitrogen line.
v) The unloader closes the valve on the outlet of the filter.
vi) The unloader opens the bleeder valve to relieve the nitrogen pressure in the filter.
vii) The unloader removes the lid and cleans the filter dumping its contents into an openhead drum
viii) The unloader replaces the lid.
ix) The unloader tests the filter gasket with nitrogen pressure.
x) The unloader opens the inlet and outlet valves on the filter.
xi) The unloader turns on the pump and continues unloading the tank wagon.

TABLE 1

GALLONS IN VOID SPACE

Inches	1A,1B	120	121-126	202-206	210-212
10	200	400	480	540	700
20	400	800	960	1080	1400
30	600	1200	1440	1620	2100
40	800	1600	1920	2160	2800
50	1000	2000	2400	2700	3500
60	1200	2400	2880	3240	4200
70	1400	2800	3360	3780	4900
80	1600	3200	3840	4320	5600
90	1800	3600	4320	4860	6300
100	2000	4000	4800	5400	7000
110	2200	4400	5280	5940	7700
120	2400	4800	5760	6480	8400
130	2600	5200	6240	7020	9100
140	2800	5600	6720	7560	9800

Unloader - Routine procedures

b) Unloading box trailers of hazardous waste at Location A.

Location A is a 4 foot raised concrete pad 56 x 50 covered by a sheet metal roof (See Figure 5). The procedure for unloading box trailers at Location A is as follows:

1) The supervisor checks the manifest papers.

2) The unloader chocks the trailer to prevent movement from the unloading pad.

3) The unloader, wearing the emergency belt, opens the door on the trailer.

4) If there is no strong chemical odor, the unloader rolls the drums in the box trailer to the raised pad. If there is a strong chemical odor, the unloader fits a respirator and sounds an alarm and awaits his supervisor's instructions.

5) The unloader must sample drums designated by the supervisor as follows:

   i) The drum is vented by slowly loosening the 2 inch bung.
   ii) After the bung is removed, a 1/2 inch tube about 3 feet long is lowered into the drum.
   iii) The unloader takes a sample by sealing the top of the tube, then removing it from the drum and emptying its contents into a jar.
   iv) Samples are brought to the lab and inspected by the supervisor.

6) If the samples are approved by the supervosor, the unloader signs the manifest papers. With reliable and regular customers shipments are accepted and unloaded before sampling.

7) The unloader removes the chocks after the trailer is unloaded.

Unloader - Routine procedures

c) Pumping hazardous waste in drums at Location A to storage tanks. A pump centrally located on the raised pad at Location A is used to pump the liquid in the drums to storage tanks in Location B or C. Figures 2,4 and 5 show the pump, lines, tanks, and valves. The procedure for pumping the liquid in the drums is as follows:

1) The unloader is instucted by the supervisor to pump the liquid in specified drums to a designated storage tank.
2) The unloader, wearing a protective suit and emergency belt, measures the void space in inches on the designated tank to check if the tank will hold the gallons of liquid in the drums. Tabel 1 shows the gallons and corresponding inches for each tank.
3) The unloader closes the valve on the discharge of the pump at Location A.
4) The unloader walks the line from the drum storage area to the storage tank, opening the proper valves and closing unused valves attached to the line.
5) The unloader sets the pin on the weld mark on the tank *approximately 5 feet off the ground.*
6) The unloader checks the tank overfill alarm.
7) The unloader opens the valve on the storage tank.
8) The unloader slowly unlooses the bung on the first drum.
9) The unloader places the charge pipe into the first drum with the valve on the charge pipe closed.
10) The unloader opens the valve on the discharge of the pump.
11) The unloader starts the pump.
12) The unloader opens the valve on the charge pump.
13) The unloader opens the air bleeder valve on the pump until air is evacuated from the system.
14) The unloader closes the valve on the charge pipe after emptying each drum so that air will not be drawn into the system.
15) The unloader closes the valve on the charge pipe and then turns off the pump after two drums are pumped.
16) The unloader walks the line looking for leaks, and he also checks the pin to make sure that the material is being pumped to the correct tank.
17) The unloader continues to pump the specified drums.
18) The unloader closes the valve on the charge pipe after the last drum is emptied.
19) The unloader turns off the pump and immediately closes the valve on the discharge of the pump.
20) The unloader closes the valve on the storage tank first and then closes the valve on the transfer line.
21) The unloader rolls the empty drums to a trailer spotted at Location A.

22) If the filter on the suction side of the drum pump should plug during pumping the following steps are taken:

i) The unloader removes the charge pipe from the drum allowing air to enter the filter to clean the liquid from the filter body.

ii) The unloader turns off the pump immediately closes the valve on the discharge of the pump.

iii) The unloader opens the lid and cleans the filter dumping its contents into an open-head drum.

iv) The unloader replaces the lid.

v) The unloader places the charge pipe into a drum and closes the valve on the charge pipe.

vi) The unloader opens the valve on the discharge of the pump and turns the pump on.

vii) The unloader continues to pump drums.

d) Part A Procedure for Emptying Drums into Box

Charging viscous liquids in drums to small blending tanks at Location A.
A 1000 gallon blending tank is used to hold liquids too viscous or thick to handle with the regular drum pump. The viscous contents of drums are dumped into a 4 x 4 box where they are pumped to the blending tank (See Figure 5). The procedure is as follows:

To assure overfill prevention, a fixxed maximum number of 16 drums is set in front of equipment before any product movement is initiated. The straining bin has a 150 gallon capacity and is emptied before adding material from another drum. The blending tank has a 1000 gallon capacity, thus the 16 drum maximum affords a safety margin. Any necessary thinning is done with the loader obseving the liquid level, through the open manway, at all time.

During the filling of the blending tank, the unloader wears protective suit and emergency belt. During emptying drums into the bin and during the emptying of the tank through the straining bin, the unloader wears a protective suit, emergency belt and a respirator.

1) The unloader rolls the drum to a position in front of the dumping ramp.
2) The unloader checks the void space in the blending tank to make sure that it can hold the contents of the drums.
3) The unloader starts the dumping box pump setting va;ves so that the liquid will be pumped to the blending tank.
4) The unloader slowly loosens the 2 inch bung and removes it from the drum.
5) The unloader slowly pushes the drum over to the horizontal position on the dumping box ramp.
6) The unloader slowly removes the 3/4 inch bung by positioning himself on the grating besides the dumping box ramp.
7) The unloader removes solid material that may collect on the dumping box screen with a shovel placing it in an open-head drum. The shovel is a special non-spark aluminum type which is dedicated to the area.
8) The unloader takes a sample of the material in the tank when it is about 2/3 full and gives it to the supervisor.
9) The unloader dumps thinning material into the dump box, if instructed by the supervisor, to thin down the viscous liquids in the blending tank.
10) The unloader rolls the empty drums to a trailer spotted at Location A.

Part B Procedure for Pulling Viscous Materials into 1000 Gallon Blending Tank (#20) with Vacuum

1) Unloader, wearing a protective suit and an emergency belt, checks the void space in blending tank to make sure that it can hold the contents of the drums to be pumped.
2) Unloader secures manway on blending tank, checks connections to vacuum pump and checks operation of float check valve.
3) Unloader applies vacuum to blending tank, allows vacuum to build in tank and checks for leaks.
4) Unloader uses $1\frac{1}{2}$" charge pipe connected to charge line at bottom of blending tank, opens valve to empty drum into tank. When drum is empty valve is quickly closed.
5) For drums too viscous for $1\frac{1}{2}$" charge pipe, 3" charge pipe is used on open head drums. Charge line valve is quickly closed when drum empties.
6) Unloader turns agitator on when tank is abour half full.
7) Unloader inspects material in tank when quantity of drums is pumped. Vacuum to tank is released and supply shut off. Sample is taken to supervisor for possible thinning or pumping instructions.
8) Unloader pumps thinning material into blending tank, observing level.
9) Unloader rolls empty drums to spotted trailer.

Unloader - Routine procedures

e) Pumping liquids in small blending tank at Location A to storage tanks in Location C.
Figures 4 and 5 show the location of the blending tank and storage tanks. The procedure is as follows:

1) The unloader is instructed by the supervisor to pump the liquid in the blending tank to a designated storage tank in Location C.
2) The unloader, wearing the emergency belt, measures the void space in inches on the storage tank to check that the tank will hold the gallons of liquid in the blending tank (usually 1000 gallons). Table 1 shows the gallons and corresponding inches for each tank.
3) The unloader walks the line from the small blending tank area to the storagr tank, opening the proper valves and closing unused valves attached to the line.
4) The unloader sets the pin on the weld mark on the tank approximately 5 feet off the ground.
5) The unloader checks the tank overfill alarm.
6) The unloader opens the valve of the storage tank.
7) The unloader turns on the pump at the blending tank.
8) The unloader opens the bottom valve on the blending tank.
    A) Unloader can also drain material frombottom of blending tank, accross screen in the 4 x 4 box (wearing a protective suit, emergency belt and a respirator) then pumps out to Location C.
9) The unloader looks into the manway of the tank to check for leaks.
11) The unloader watches the pin move on the gauge to check that the material is being pumped to the proper storage tank.
12) The unloader remains in the area during the pumping of the material.
13) The unloader, wearing a respirator, watches the blending tank to empty and then closes the bottom valve on the tank.
14) The unloader turns off the pump and immediately closes the discharge valve on the pump.
15) The unloader closes the valve on the storage tank first and then closes the valves on the transfer line.

19) The loader turns off the loading pump.
20) The loader closes all valves between the storage tank and the tank wagon except for the valve on the tank wagon.
21) The loader blows the loading hose clear with nitrogen to remove any liquid in the line.
22) The loader closes the valve on the tank wagon.
23) The loader opens the bleeder valve on the line to relieve the nitrogen pressure.
24) The loader disconnects the loading hose.
25) The loader samples the tank wagon from the manway.
26) The loader closes the manway and vent valve.
27) The loader fills out the tank wagon manifest with the supervisor's approval.
28) The loader has the driver sign the manifest.
29) The loader retains the generator copy and returns it to the supervisor.
30) The loader disconnects the grounding device and removes the chocks.
31) The loader informs the driver that all valves are closed and hoses are disconnected.
32) If the filter on the loading pump should plug during loading, the following steps are taken:

    i) The loader closes the valve on the suction side of the filter.
    ii) The loader turns off the loading pump.
    iii) The loader opens the nitrogen valve on top of the filter to blow material out of the filter.
    iv) The loader closes the valve on the nitrogen line.
    v) The loader closes the valve on the outlet of the filter.
    vi) The loader opens the bleeder valve on the filter to relieve the pressure in the filter.
    vii) The loader removes the lid and cleans the filter by dumping its contents into an openhead drum.
    viii) The loader replaces the lid.
    ix) The loader tests the filter gasket with nitrogen.
    x) The loader opens the inlet and outlet valves on the filter.
    xi) The loader turns on the pump and continues loading the tank wagon.

3) Loaders

Loaders pump hazardous waste in storage tanks at Location C to a tank wagon in the loading area (See Figure 4).

Routine procedures are as follows:

a) Loading tank wagons with hazardous waste.

Hazardous waste is pumped from storage tanks in Location C to a tank wagon in the loading area. Figure 4 shows the location, pump, piping and valves for each tank. The gauges on the storage tanks are counterweight float type. When the counterweight is at the bottom of the tank, the tank is full. When the counterweight is at the top of the tank, the tank is empty. Table 2 shows the gallons of material and corresponding inches on the straight side of each tank. The procedure for loading tank wagons is as follows:

1) The supervisor instructs the loader to load the tank wagon with a specified amount from a specified storage tank.
2) The loader, wearing a protective suit and a emergency belt, vents the tank wagon.
3) The loader opens the manway on the tank wagon.
4) The loader inspects the tank wagon to make sure that it is empty.
5) The loader connects the grounding device to the frame of the tank wagon and places the chocks to prevent movement in both directions.
6) The loader informs the truck driver that the tractor ignition must be turned off if he is outside the cab.
7) The loader connects the loading hose to the tank wagon.
8) The loader walks the line from the tank wagon to the storage, opening the proper valves and closing unused valves attached to the line.
9) The loader sets the pin on the weld mark on the tank approximately 7 feet off the ground.
10) The loader opens the valve on the storage tank.
11) The loader turns on the loading pump.
12) The loader walks the line from the storage tank to the tank wagon to check for leaks.
13) The loader looks into the top of the wagon to check that material is being pumped to the tank wagon.
14) The loader watches the pin move on the gauge at the tank to check that material is being pumped to the proper tank.
15) The loader checks the transfer line periodically to make sure that no one has changed the valve settings and that the line is not leaking.
16) The loader remains in the area during the pumping of the material.
17) The loader checks the tank wagon level periodically to make sure that the specified amount will fit into the tank wagon.
18) The loader closes the valve on the storage tanks when the pin reaches the specified mark.

4) Tractor driver

Some shipments of drums of hazardous waste arrive in trailers which are not the same height as the raised pad at Location A. The tractoe driver unloads the drums from the trailer and hauls them to the raised pad.

a) Unloading trailers of hazardous waste with the tractor.

Trailers, that are not the same height as the raised pad, are usually spotted in the area west of location A. Drums are transferred by the tractor driver to the raised pad. The procedure is as follows:

1) At the direction of the supervisor the tractor driver opens the doors of the trailer.
2) The tractor driver positions the tractor at the rear opening of the trailer with the drum bucket flush with the trailer floor.
3) The tractor driver chocks the trailer to prevent movement in both directions.
4) If there is no strong chemical odor, the tractor driver rolls 6 drums into the tractor bucket. If there is a strong chemical odor, the tractor driver makes his supervisor aware and awaits his instructions.
5) The tractor driver slowly raises the bucket about 6 inches and backs away from the trailer.
6) When the bucket is about 5 feet from the trailer, the tractor driver lowers the bucket to 1 foot from the ground.
7) The tractor driver transports the drums to the raised pad to unload them.
8) When the supervisor approves the drums, the tractor driver rolls them to a designated area.
9) The tractor driver continues to unload the trailer until it is empty.
10) The tractor driver removes the chocks.

5) Laborer

Laborers assist tractor drivers and unloaders in unloading box trailers and pumping drums. Their efforts are regularly directed by supervisors, unloaders or tractor drivers and they wear the same PPE previously mentioned in this section. They also dig solids which collect in the storage tanks and stills during processing. The routine procedures are as follows:

a) The laborer rolls drums from a box trailer to the tractor bucket or the raised pad at Location A.
b) The laborer assists the unloader in pumping drums at Location A by opening bungs on designated drums or transferring the charge pipe from one drum to another which is already opened.
c) The laborer assists the unloader in charging viscous liquids from drums to the small blending tank by rolling drums to the dump box ramp or dumping their contents into the dump box.
d) The laborer assists the unloader in solidifying solid material in drums by draining any free liquid from solid drums. This drained liquid is put into drums for future pumping to Location C.
e) The laborer rolls empty drums to the spotted trailer.
f) The laborer digs solids which collect in stills and storage tanks during processing. The procedure is covered under the Hazardous Atmosphere Entry Program.

6.) Solids Pail Loader

Work outline for the filling of 6 gallon pails of hazardous waste flammable solid material packaged and stored on pallets of 36 pails each.

A. The following list of equipment and tools to be used.

1. Mixing Tub
2. Filling Funnel
3. Plunger
4. Aluminum Shovels
5. Brass Hammer
6. Tow Motor & Fork Extender
7. Misc. Drum Opening Tools (Bung Wrench, Speed Wrench etc.)
8. Drum Tilter
9. Barrier Tape or Rope
10. Cones or Stanchions
11. PPE Personal Protective Equipment(Respirator with R-21 Cartridges with back up R-21 cartridges available)
12. Scale
13. Lid Crimper
14. Air Signal Horn
15. Eye Wash available

B. Following list of material to be secured

1. Bag(s) of Slikwik
2. 36-6 gallon pails
3. 1-GMA Pallet 40" x 48" (Pallet to be four way entry)
4. 36 Dot (Flammable Solids) and Hazardous Waste Labels (yellow)
5. Black felt tip marker
6. Chem-Fuel's Blend Log Sheet
7. Clip board, pen and pencil
8. Full or partial full 55 gallon drums of hazardous waste solids
9. 4 oz. sample jars
10. Paper towels

C. Secure the area around the mixing tub. (Refer to area layout attached) Notify the Site Health and Safety Officer for the purpose of inspection of the area and permission to proceed.

D. Locate the equipment and materials to be handled in the proper locations. (Either inside or outside containment area) Affix the proper PPE. The drum that is to be dumped into mixing tub must first be checked with the MX-241 for any sign of a high LEL reading.

E. With the Fork Extender attached to the Towmotor and the Drum Tilter fastened to the drum, dump the contents of drum into Mixing Tub. Use brass hammer and aluminum shovel to remove all the waste material from drum.

F. Secure the empty drum.

G. The mixing tub is to be checked again with the MX-241 to assure LEL level has not risen due to agitation of the material when dumping from the drum to the mixing tub. Size solids in the mixing tub and add Slikwik if necessary, to pick up any liquid that may be present. Take a 4 oz. sample of the solids in the mixing tub and record drum number on lid.

H. Place an empty 6 gallon pail under the funnel and shovel the solids from the mixing tub unto the funnel until the pail is full. Use the plunger to compress the mixture but do not exceed the top 1" rolling hoop (if Slikwik is added to the top of the pail, this also must be compressed so as not to exceed the top rolling hoop.)

I. The outside appearance of the pail is very important. Clean the pail sides with paper toweling, if necessary, and discard the dirty paper toweling into the next pail to be filled. The clean pail can now be removed from the secured area and placed in the designated Weigh and Label Area.

J. Continue filling the pails until the mixing tub is empty. All the solids that were emptied from drum No. 1 should be now in 6 gallon pails and stored in the Weigh and Label Area.

K. PPE is to remain on in the secured area during the filling operations. Remove and secure PPE (Protective suits, rubber gloves, respirator, etc.) before moving to the Weigh and Label Area.

L. Weigh pails, crimp the lids and record pounds on the lid(6 gallon pails are 26 guage and are not to exceed 60 pounds gross). Pail lids are also to be marked with the pallet letter and pail number. This information is then transferred to the Chem-Fuel "S" Blend Log Sheet along with the generator name, manifest document number and hazardous waste code.

M. DOT #4 Flammable Solid Label and Hazardous Waste Label are affixed to pail and stacked on pallet.

N. The Site Safety and Health Officer will monitor the transferring operations and make adjustments to the PPE based on his monitoring results. Each drum may require an upgrading or downgrading of the PPE level.

O. The Pail Filler will return to step "D"- affix the required PPE and begin operations on the next drum to be processed.

P. Shutdown and Decontamination Procedure:
   1. Scrape all the solids from the equipment used into the mixing tub.
   2. Remove the collected solids from the mixing tub and deposit them into a partially filled or empty drum of the same waste code.

3. Remove the PPE according to normal decontamination procedures. Disenfect and properly store the respirator.
4. Unsecure the area and return all equipment and unused materials.

Q. Return the empty drums to the proper storage area. Return the partially or full solid drums to the proper storage area.
Move partially or full pallets of pails to the designated storage area, return the Chem-Fuel "S" Blend Log Sheet and the samples to Production Supervisor.

CHEM-FUEL S BLEND
AREA LAYOUT
(TYPICAL)

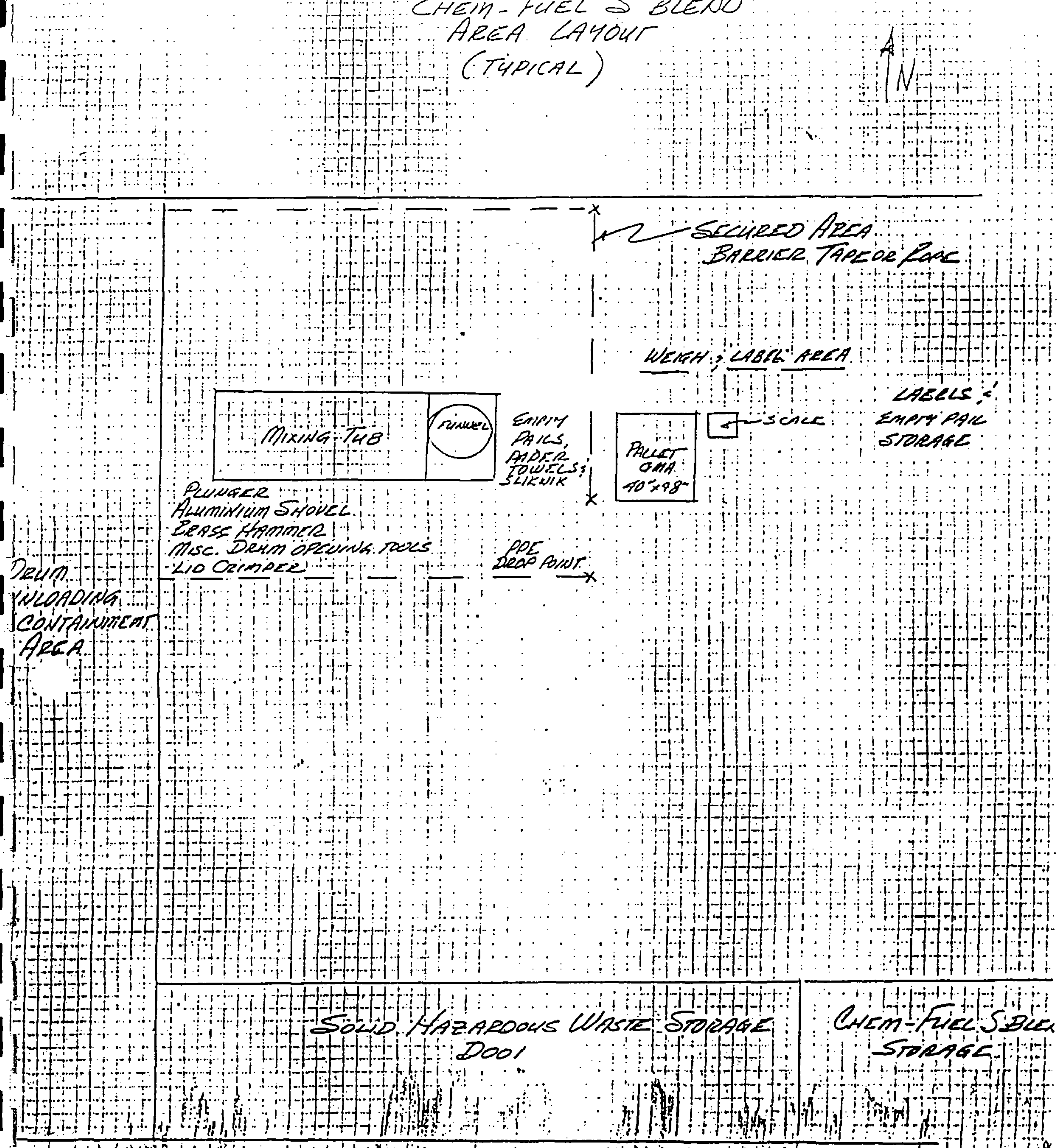
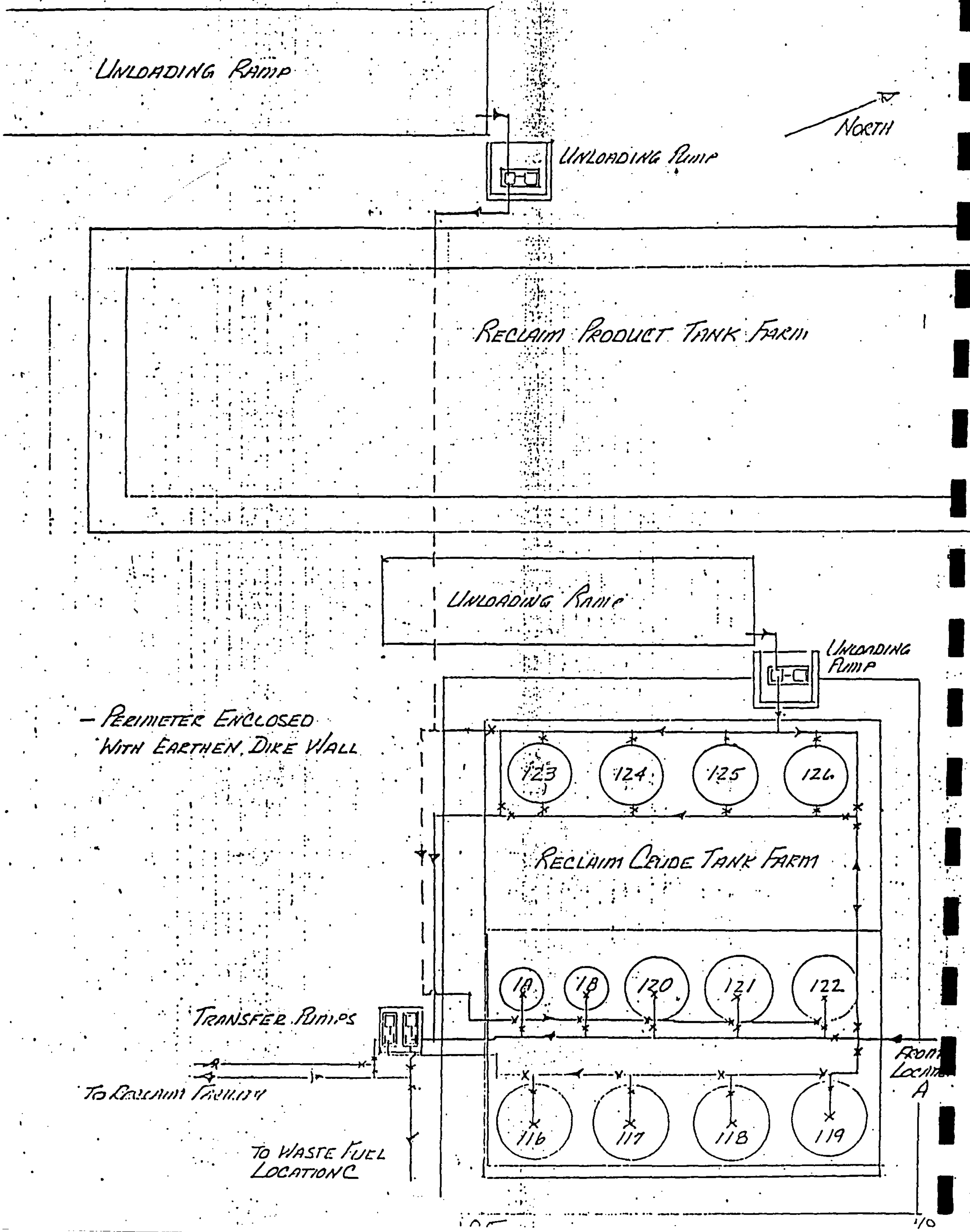
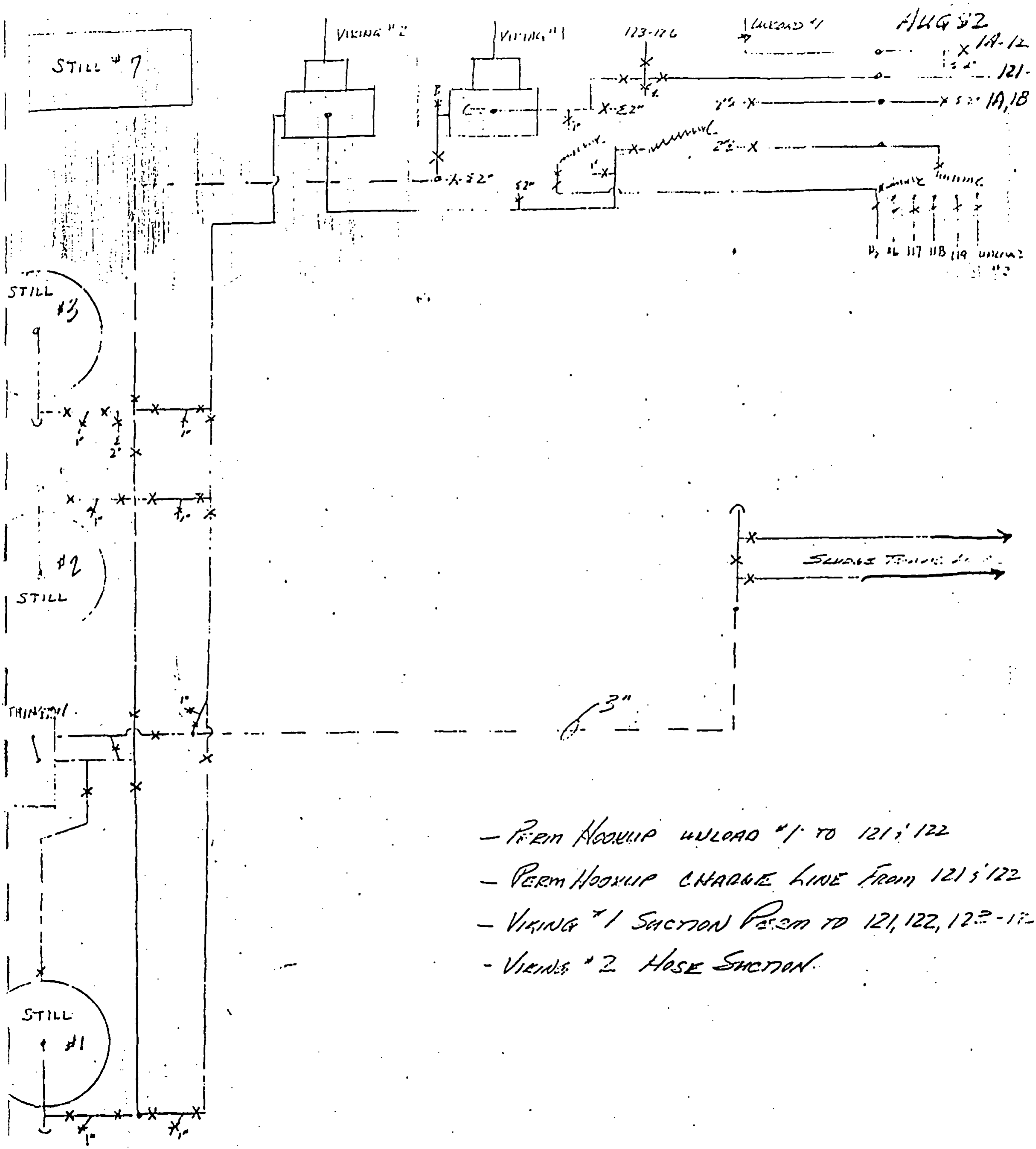


FIGURE 2
RECLAIM CRUDE LOCATION B
SCALE 1" = 20'

AUG 82





- PERM HOOKUP UNLOAD #1 TO 121 & 122
- PERM HOOKUP CHARGE LINE FROM 121 & 122
- VIKING #1 SUCTION PERM TO 121, 122, 123-12-
- VIKING #2 HOSE SUCTION

FIGURE 3

Aug 82

FIGURE 4
Waste Fuel Location C
Scale 1" = 20'

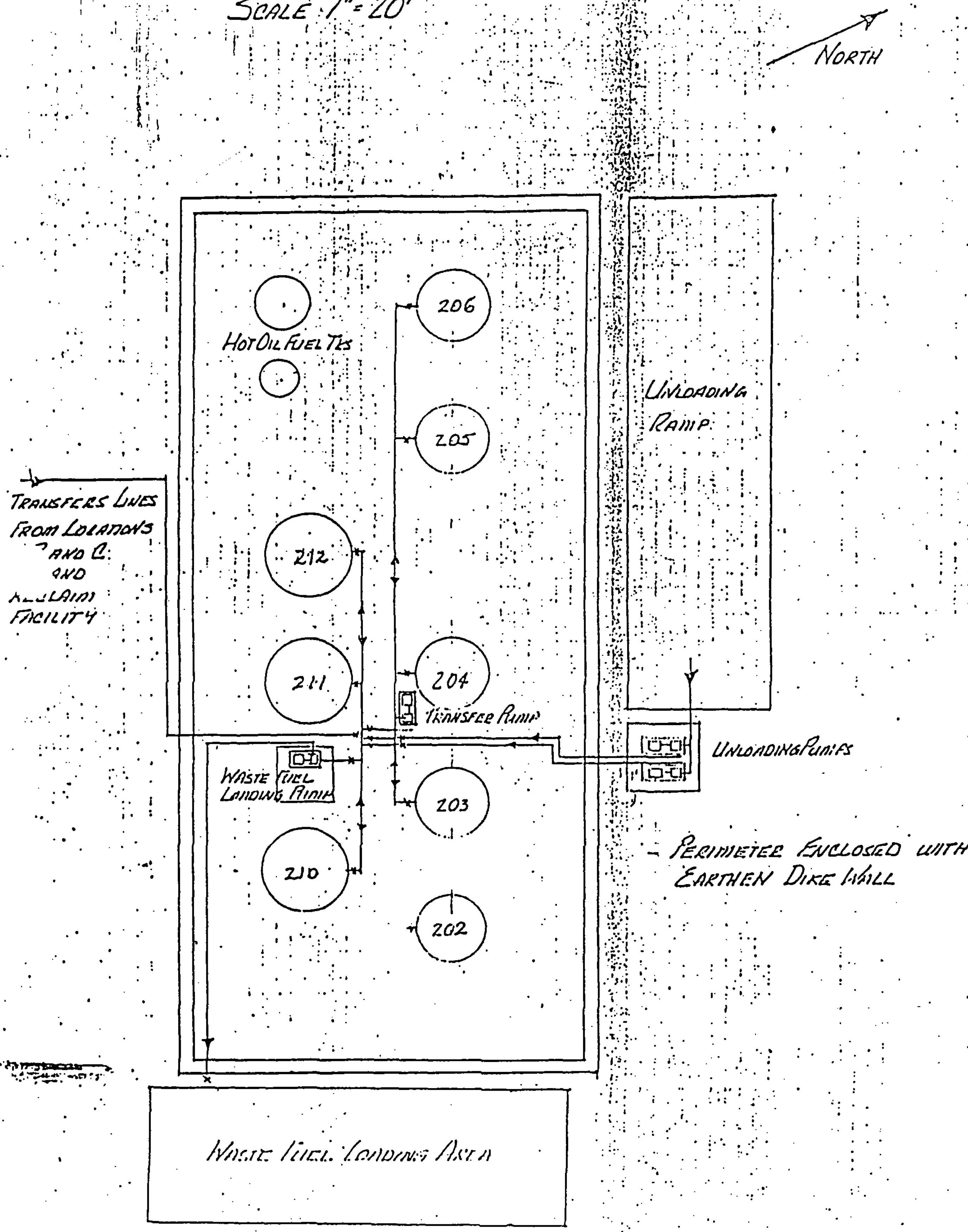
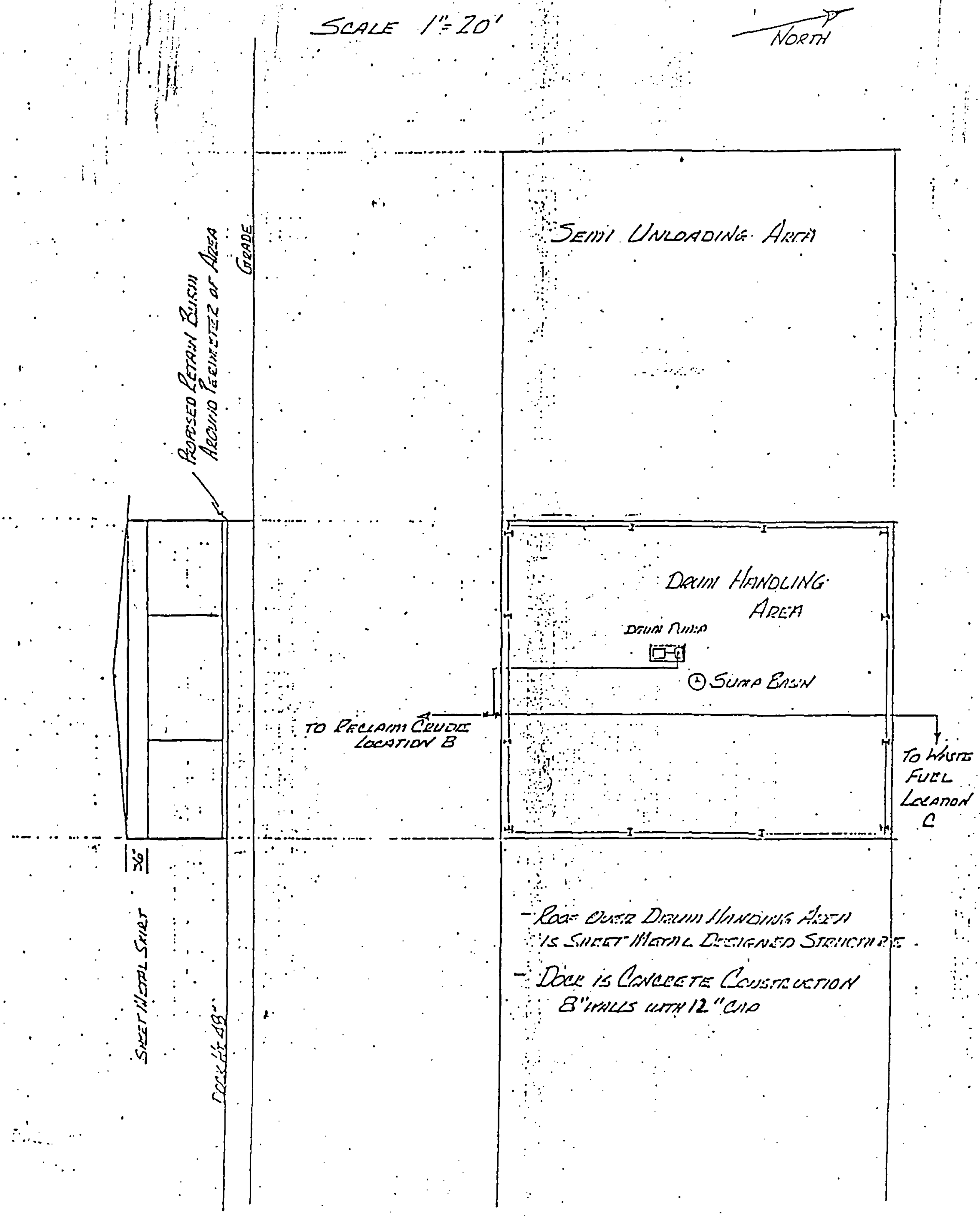


FIGURE 5
DRUM UNLOADING DOCK LOCATION A
SCALE 1" = 20'

JUNE 26, 1986



SECTION J:

CONTINGENCY PLAN

J.) Contingency Plan:

This section addresses the requirement to develope a plan for safe and effective responses to emergencies. The development of a plan must first identify the types of emergencies which would likely occur at ACS and they are as follows:

1.) Injured employee
2.) Spill of hazardous material
    A. Minor
    B. Major
3.) Fire and/or explosion involving a hazardous material

The emergency response to an injured employee is covered by the Plant Personal Injury Response (J-1). The response to a spill (Minor or Major) is covered by the ACS Contingency Plan J-2. The emergency response to a fire and/or explosion is also covered in J-2. Included in J-2 is a section of the following topics:

1.) State of Readiness
2.) Evacuation Plan for ACS employees
3.) Emergency Equipment

The updating, training and implementation of the contingency plan is covered in J-3.

American Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

DATE: 14 May 1987

PERSONNEL: ALL ACS PLANT EMPLOYEES

TOPIC: PLANT PERSONAL INJURY RESPONSE

The following procedure will be followed in responding to an injured employee:

1. The injured employee or a follow employee must sound the Plant Emergency Alarm for assistance by dialing 71 on the Com Line.

2. Personnel responding to the Plant Emergency Alarm are required to put their operations in a shutdown mode prior to leaving their area.

3. The assisting employee(s) must put the injured employee's operations in a shutdown mode and administer the necessary emergency aid to the injured employee such as:
   A. Emergency shower washdown
   B. Emergency eye wash
   C. Removal for fresh air
   D. Removal of contaminated clothing
   E. Minor First Aid

4. Call an ambulance and dispatch an employee to the front gate to direct the ambulance. In situations of limited manpower, open the front gate, pull the gate main on the control box and return to the injured employee. The ambulance will find your location.

5. If possible, answer all questions of the paramedics as to what aid was given and the circumstances of the accident.

6. A supervisor will issue an admittance slip for the clinic and locate a copy of the MSDS Sheet(s) covering the material(s) involved in the accident. If a supervisor is not available the assisting employee will issue the admittance slip and MSDS Sheet(s) to the ambulance paramedics.

7. Before the ambulance departs, find out where the injured employee is being transferred.

8. If only two employees are on a shift, contact the supervisor on call. The supervisor will contact the relatives of the injured employee and give information concerning the accident and the location of the injured employee.

9. When available, a company representative will accompany the injured employee to the clinic with the admittance slip and a copy of the MSDS Sheet(s) for the attending physician. This is not possible when only two employees are on a shift.

10. The non-injured employee(s) will remain at the plant and checkout the facilities for proper shutdown. Operations will resume only when a replacement for the injured employee arrives and the supervision gives approval.

11. During the shutdown mode, a written detailed description (date, times, names, etc.) of the accident and the response will be drafted by the assisting employee or a supervisor. The Plant Safety Officer will prepare a Personal Injury Report Form from this information.

Attached is a list of emergency phone numbers. Sign the attached sheet to acknowledge your understanding of this policy.

The ACS Safety Committee

SUPERVISORS ON CALL:

James Murphy	322-4125	or beeper 755-2472
John Murphy	1-464-2076	or beeper 755-2660
Ray Murphy	1-365-3763	or beeper 755-2519
Thomas Murphy	838-0636	or beeper 738-0866
Harrold Schmidt	322-4648	or beeper 738-0864
Milton Popa	322-4337	or beeper 738-0865

AMBULANCE:

Fagen Miller	838-4818

POLICE:

Griffith Police	924-3141
State Police	769-8459

FIRE DEPARTMENT:

Griffith	924-3151

AMERICAN CHEMICAL SERVICE IND 016 360 265

CONTINGENCY PLAN AMENDED 2-89

I Description

American Chemical Service, owner and operator, is located at 420 S. Colfax Avenue in Griffith, Indiana.

American Chemical Service's business consists of Custom Chemical Manufacturing, solvent reclaiming, and processing of hazardous wastes. On site is the equipment to receive, process, and ship various solvents and chemicals in drums and bulk.

Figure 1 shows the property boundaries, adjacent highway, holding pond, tank area, on site buildings, and access road with sufficent aisle space.

Figure 1 shows the three locations where hazardous materials are stored. Figures 2,3,4, Location A,B,C show detailed drawings of each location. A dike surrounds each fixed storage area.

Location A shown in Figures 1 and 2 is used for storage of 55 gallon drums. These drums contain crude solvents to be processed. Crude solvents are pumped to storage tanks in Location B and hazardous wastes are pumped to storage tanks in Location C. A maximum of 300 drums is stored in Location A. A curb surrounds the drum storage area.

Location B shown in Figures 1 and 3 is used for the storage of crude solvents to be reclaimed. Bulk shipments are unloaded with a pump at the western boundary. These solvents are processed in the reclaim facility shown in Figure 1.

Location C shown in Figures 1 and 4 is used for the storage and processing of hazardous waste. Bulk shipments are unloaded with a pump at the northern boundary. Outgoing shipments are pumped to a tank wagon spotted at the eastern boundary.

II Purpose and Implementation

The purpose of the contingency plan is to minimize hazards to human health or the environment from fires, explosions or spills of hazardous materials.

The emergency coordinator is notified for the following emergencies:

1.) A minor spill of hazardous material greater than five gallons outside a diked or curbed area in Location A,B.C.
2.) A major spill of hazardous material of 2000 gallons or more.
3.) A fire or explosion involving hazardous material.

Based on the severity, extent, nature and danger of the emergency to human health or the environment the emergency coordinator directs plant personnel to the correct response action by implementing the contingency plan.

III 1) Plant Personnel Response Action to Minor Spills

A minor spill is a small spill of hazardous material greater than 5 gallons outside the tank farms in Location B and C or outside the curbed area in the drum storage area in Location A.

- -Contain the spill with the materials in the closest spill response kit.
- -Notify, call or beep the emergency coordinator for a minor spill.
- -Carry out immediately one or more of the following actions ordered by the emergency coordinator:
  - -Call plant section on intercom that he ordered to a state of readiness (see page 16);
  - -Sound Alarm (Dial 71); call plant section that he ordered to shutdown (see page 16-18).

In general the emergency coordinator orders shutdown of section within 50 feet of spill and state of readiness for rest of plant.

To carry out cleanup of a minor spill the emergency coordinator:

- -Inspects spill area;
- -Check human contact or injury and tells employee to:
  - -Wash contacted area of body,
  - -Change clothing,
  - -Visit Hammond Clinic for injury or if the material was taken internally;
- -Evacuates personnel at least 20 feet from the spill area upwind, if possible;
- -Determines exact source (i.e. drum, tank, or tank wagon);
- -Consults daily tank log, hazardous drum label, or tank wagon manifest to identify makeup of spill. (Materials are flammable liquids (D001,F003,F005) and spent liquid halogenated solvents (F001,F002.); See page 4.
- -Confirms that the spill is small in area, not moving, and no threat to areas around the spill or outside the plant;
- -Tells personnel to:
  - -Keep yard tractor, trucks, and cars at least 30 feet from spill,
  - -Shutdown spark sources within 60 feet of spill (i.e. fume incinerator, hot oil heater),

1.) F001, F002

This group consists of spent halogenated solvents used in degreasing, methylene chloride, 1,1,1-trichloroethane, trichloroethylene and perchloroethylene, and the still bottoms from the recovery of the solvents.

The waste is hazardous because it contains listed compounds.

2.) D001

This group consists of spent solvents, waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability.

3.) F003, F005

This group consists of spent solvents waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability and it contains listed compounds.

- Place dry chemical engine 30 feet from spill,

- Place the barrel house portable pump 30 feet from the spill,

- Wear a protective suit and breathing appartus before going to the edge of the spill area,

- Pump the spill and any contaminated ground water to a storage tank by placing suction hose in the free liquid and the discharge hose to a storage tank in Location B or C (All hazardous wastes accepted at the plant are compatible),

- Pump contents of the drum, tank or tank wagon to a storage tank in Location B or C if the container continues to leak:

- Remove pump and hoses to drum storage area in Location A,

- Transfer contaminated spill response materials into openhead drums,

- Transfer contaminated ground into openhead drums,

- Haul drums, shovels, and protective clothing to drum storage area,

- Check areas that were shutdown during cleanup (i.e. fume incinerator),

- Initiate corrective repairs to defective equipment that caused spill,

- Scrape shovels until clean (Put scrapings with contaminated ground in openheads),

- Replace used spill response materials in the spill response kit,

- Flush pump and hoses with clean solvent (Pump solvent to a storage tank in Location B or C),

- Store contaminated ground, spill response materials and clothing in openhead drums in the drum storage area until it is hauled to secure landfill,

- Initiate repairs to defective equipment and containers that caused spill or isolated them from use,

- Report that the emergency equipment is ready for another emergency,

- Communicate all-clear signal to resume normal operations, The emergency coordinator:

-Does not call the Regional Administrator, State, or local authorities since the spill was small and within the boundaries of the plant;

-Enters time, date, and details of spill in the operating record;

-Does not file a written report to the Regional Administraror since spill was small.

III 2) <u>Plant Personnel Response Action to Major Spill of Hazardous Material</u>

-Notify, call or beep the emergency coordinator for a major spill of hazardous material.

-Carry out immediately one or more of the following actions ordered by the emergency coordinator:

-Call plant sections on intercom that he ordered to a state of readiness (see page 16);

-Sound alarm (Dial 71); call plant sections that he ordered to shut down (see page 16-18).

In general the emergency coordinator orders shutdown of section within 50 feet of major spill and state of readiness for rest of plant.

To carry out the cleanup of a major spill the emergency coordinator:

-Inspects spill area;

-Checks human contact or injury and tells employee to:
-Wash contacted area of body,
-Change clothing,
-Visit Hammond Clinic for injury or if material was taken internally;

-Evacuate personnel at least 40 feet from spill containment area upwind, if possible, and account for plant personnel;

-Determines exact source (i.e. tank or tank wagon)

-Consults daily log or tank wagon manifest to identify makeup of spill. (Materials are flammable liquids (D001,F003, F005) and spent liquid halogenated solvents (F001,F002). They require a protective suit and breathing apparatus for contact; See page 8.

-Confirms that the spill is contained, stagnant, and no threat to areas outside the plant;

-Determines the final containment area if the spill is moving;

-Shuts off flow of water from holding pond to sewer if spill reaches pond via runoff system (Spill collects in the inlet section. The spill control plan shows that spills can be contained within the plant boundary);

1.) F001, F002

This group consists of spent halogenated solvents used in degreasing, methylene chloride, 1,1,1-trichloroethane, trichloroethylene and perchloroethylene, and the still bottoms from the recovery of the solvents.

The waste is hazardous because it contains listed compounds.

2.) D001

This group consists of spent solvents, waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability.

3.) F003, F005

This group consists of spent solvents waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability and it contains listed compounds.

- Calls the National Response Center (800-424-8802) and reports:

  - James Murphy or other emergency coordinator and
  - 219-924-4370
  - American Chemical Service, Inc.
    420 S. Colfax
    Griffith, Indiana 46319
  - Time and word "Spill"
  - Makeup of spill and quantity (i.e. D001 and gallonage),
  - Human contact or injury.
  - Hazards to human health are low since spill is contained within the plant boundary and protective gear is available.

- Notifies the Griffith Fire Department (924-3151) and the Indiana Response Center (317-633-0144) and gives the same information as before,

- Tells personnel to:

  - Keep yard tractor, trucks, and cars a least 40 feet from spill,

  - Shutdown spark sources within 60 feet of spill (i.e. fume incinerator and hot oil heater),

  - Place a dry chemical engine 40 feet from spill area,

  - String fire hose from Foam System F1, F2 or F3 to within 40 feet with the spray nozzle and foam container in place,

  - Position the barrel house portable pump 40 feet from the spill upwind, if possible,

  - Wear a protective suit and breathing apparatus before going to the edge of the spill area,

  - Pump the spill and any contaminated ground water to a storage tank by placing the suction hose in the free liquid and the discharge hose to a storage tank in Location B or C. (All hazardous wastes accepted at the plant are compatible. Rarely are all storage tanks full.),

  - Pump contents of drum, tank or tank wagon to a storage tank in Location B or C if container continues to leak;

  - Skim spill from inlet section of holding pond to a storage tank, if applicable, and sample water left in holding pond (In general hazardous wastes accepted at the plant have a low solubility in water.),

- Use Mr. Frank vacuum truck if spill location is remote,

- Remove pumps and hoses to drum storage area in Location A,

- Rope off the area after free liquid is removed until ground cleanup begins,

- Transfer contaminated ground with a front end loader-backhoe or caterpillar tractor owned and operated by Wells Hauling and Excavating (219-884-3757 or 219-755-2658 beeper) into dump trucks owned and operated by Mr. Frank, Inc. (312-596-3377 or 312-785-7190),

- Check areas every hour that were shutdown during cleanup (i.e. fume incinerator),

- Initiate corrective repairs to defective equipment that caused spill or isolate it from use,

- Contact Mr. Frank, Inc. (312-596-3377) to obtain an Emergency Spills Permit with C.I.D. for the ground that was removed (see Mr. Frank letter dated July 24, 1985),

- Scrape bucket of backhoe and shovels until clean (Put scrapings in openheads and store in drum storage area until it is hauled to a secure landfill. Mr. Frank is approved to clean his own equipment.),

- Flush pump and hoses with clean solvent (Pump solvent to a storage tank in Location B or C.),

- Recoil fire hose and replace foam nozzle and foam container,

- Report that the emergency equipment is ready for another emergency,

The emergency coordinator:

- Calls the Regional Administrator (800-424-8802) and the Indian Response Center (317-633-0144) that the plant is not storing incompatible wastes from the spill and that all emergency equipment is fit for its intended use;

- Gives all-clear signal to resume normal operations;

- Enters time, date, and details of spill in the operations record;

- Files a written report within 15 days to the Regional Administrator stating:

  - James Murphy - owner-operator
    135 Holly Lane
    Schererville, IN 46375
    219/322-4125

- American Chemical Service, Inc. - facility
  420 S. Colfax Avenue
  Griffith, Indiana 46319
  219-924-4370

- Date, Time and Spill,

- Human Contact or Injury

- Makeup and amount (i.e. D001 and gallons.)

- Hazards to human health were low since the spill was contained and protective gear was used,

- Injuries if any,

- Gallons of spill pumped to storage tanks and yards of ground removed from the spill area and location of landfill (The recovered liquid was used in normal processing since all wastes are compatible.).

III 3) <u>Plant Personnel Response Actions to Fire or Explosions Involving Hazardous Material</u>

-Notify, call or beep the emergency coordinator for a fire or explosion involving hazardous material.

-Carry out immediately one or more of the following actions ordered by the emergency coordinator:

-Call plant sections on intercom that he ordered to a state of readiness

-Sound alarm (Dial 71); call plant sections that he ordered shutdown

-Sound alarm (Dial 71); call plant sections that he ordered to evacuate.

In general the emergency coordinator orders:

-For small fires, (those that can be extinguished with hand-held extinguishers) shutdown of sections within 100 feet of fire and state of readiness for rest of plant,

-For large fires or explosions, shutdown of all sections.

There is no local agency at this time set up for an immediate response role. The emergency coordinator orders all actions.

For a Fire the emergency coordinator:

-Observes the fire and tanks, drums, or tank wagons near the fire;

-Evacuates personnel upwind at least 100 feet from large fires and 40 feet from other fires and account for personnel;

-Checks human contact or injury and tells employee to:

-Wash contacted area of body,
-Change clothing,
-Visit Hammond Clinic for injury, or if material was taken internally, or if combustion gases were inhaled deeply;

-Determines the source (i.e. tank, drum, or tank wagon);

-Consults daily tank log, drum label, or tank wagon manifest to identify the material. (Materials are flammable liquids (D001,F003,F005) and spent liquid halogenated solvents (F001 F002). They require a protective suit and breathing apparatus for contact.); See page 13

-Checks daily log for amount and identity of material in tanks near the fire;

1.) F001, F002

This group consists of spent halogenated solvents used in degreasing, methylene chloride, 1,1,1-trichloroethane, trichloroethylene and perchloroethylene, and the still bottoms from the recovery of the solvents.

The waste is hazardous because it contains listed compounds.

2.) D001

This group consists of spent solvents, waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability.

3.) F003, F005

This group consists of spent solvents waste paints and resin solutions from paint manufacture and use; spent solvents and inks from printing operations; spent solvents from pharmaceutical manufacture; spent solvents from chemical processes.

The waste is hazardous because it exhibits the characteristic of ignitability and it contains listed compounds.

-Checks smoke from fire (Dense black smoke indicates high organic loading);

-Checks direction the smoke is heading;

-Checks if fire is heating a nearby tank;

-Checks if there is heavy venting from tank vent. (This condition is a potential explosion);

The emergency coordinator tells personnel to:

-Order tank wagons and box trailer trucks not involved in fire to move away or leave plant (Trucks must stay at least 100 feet from fire while driving out of plant.);

-Wear a protective suit and, if not upwind, a breathing appartus when fighting fire;

-Put out a small fire with a hand-held fire extinguisher; stand upwind, aim nozzle at base of flame about 3 feet away (Fire extinguishers are readily available throughout the plant);

-For large fire in Location A use Foam System F2;

-For large fire in Location B use Foam System F1, F2;

-For large fire in Location C use Foam System F2 (See Figure 1 for location.);

-For large fire in Location D use Foam System F1;

-Set up foam container, nozzle, and hose about 70 feet from fire upwind, if possible;

-Turn on fire pump;

-Roll foam onto fire by hitting the ground in front of the fire or banking off a wall near the fire;

-Report if fire is spreading or abating;

-Shut off flow of water from holding pond to sewer if foam or spill has reached the inlet compartment of holding pond;

-Call Griffith Police Department (924-3141) in case of a large fire to block intersections at Colfax and Main, Colfax and Reder allowing only emergency vehicles to pass;

- Tell Griffith Police to evacuate areas of town if dense black smoke or vapor releases for D001, F003, F005 liquids are leaving boundary of plant (For spent liquid halogenated solvents (F001, F002) combustion gases are acidic and irritating. People inhaling them should seek medical attention.).

- Call Hammond Clinic (219-836-5800) that people from Griffith may require treatment for inhalation of acidic gases.

- Call Griffith Fire Department (924-3151) to report to plant gate (Plant personnel will meet them at gate and lead them to an area designated by the emergency coordinator. Foam is generally used to fight chemical fires. The town has conventional fighting equipment and can fight building fires, brush fires, etc. Additions of large amounts of water to a chemical fire usually spreads the fire since the fuel floats on water.);

- Call National Response Center (800-424-8802) and report:

  - James Murphy or other emergency coordinator at 219-924-4370
  - American Chemical Service, Inc.
    420 S. Colfax
    Griffith, Indiana 46319
  - Time and word "Fire",
  - Makeup of fire and quantity (i.e. D001 and gallonage),
  - Human contact or injury
  - For a small fire that hazards to human health are low since fire is being put out quickly and protective gear is available,
  - For a large fire that police are to evacuate areas downwind if there is dense black smoke; protective gear is used by contacted plant personnel when fighting fire; and liquid from spill and foam system is being contained within plant boundary;
  - For large fire (F001, F002 liquid) that combustion gases are acidic and irritating and evacuated people may require medical attention for inhalation;

- Draw back to a new fire line to protect other portions of the plant if the liquid and fire are spreading (Do not let fire jump the fighting line.);

- Check sections every hour that are shutdown during the fire (i.e. stills, additives, etc.);

- Determine when fire is out;

- Release Griffith Fire Department;

- Tell Griffith Police Department that the fire is out; to take down road blocks and to reinhabit evacuated areas when air is clear;

- Determine total contaminated area when fire is out;

- Check that foam liquid and spill from the fire is not moving and is contained;

- Check fire area frequently to make sure that it does not restart;

- Check shutdown section every hour after fire is out;

- Get portable pump from barrel house;

- Pump foam liquid and spill to a storage tank in Location B or C (All wastes accepted at the plant are compatible. Rarely are all storage tanks full.);

- Skim spill from inlet section of holding pond to a storage tank, if applicalble, and sample water left in holding pond (In general hazardous wastes accepted at the plant have a low water solubility.);

- Use Mr. Frank vacuum trucks for remote spill areas;

- Remove pump and hoses to drum storage area in Location A;

- Rope off area after free liquid is removed until ground cleanup begins;

- Transfer contaminated ground with a front end loader-backhoe or caterpillar tractor owned and operated by Wells Hauling and Excavating (219-884-3757 or 219-755-2658 beeper) into dump trucks owned and operated by Mr. Frank, Inc. (312-596-3377 or 312-785-7190);

- Check shutdown areas every hour during cleanup;

- Initiate corrective repairs to defective equipment that caused fire;

- Contact Mr. Frank, Inc. (312-596-3377) to obtain an Emergency Spills Permit with C.I.D for the ground that was removed (See Mr. Frank letter dated July 24, 1985);

- Scrape bucket of backhoe and shovels until clean (Put scrapings in openheads and store in drum storage area until it is hauled to a secure landfill. Mr. Frank is approved to clean his own equipment.);

- Flush pump and hoses with clean solvent (Pump solvent to a storage tank in Location B or C.);

- Recoil fire hose; put back foam nozzle and foam container; and check that there are enough foam containers to fight another fire;

- Replace or recharge dry chemical engines and fire extinguishers that were used;

- Report that the emergency equipment is ready for another emergency;

The emergency coordinator:

- Calls the Regional Administrator (800-424-8802) and the Indiana Response Center (317-633-0144) and reports that the plant is not storing imcompatible waste from the fire and that all equipment is fit for its intended use;

- Gives the all clear signal to resume normal operations in other sections of plant;

- Does not permit startup of section affected by fire until all equipment is fixed or isolated from use;

- Enters time, date, and details of fire in operating record;

- Files a written report within 15 days to the Regional Administrator stating:

  - James Murphy - owner-operator
    135 Holly Lane
    Schererville, IN 46375

  - American Chemical Service, Inc. - facility
    420 South Colfax
    Griffith, Indiana 46319
    219-924-4370

  - Date, time, and word "Fire",

  - Makeup of fire and quantity (i.e. D001 and gallons involved in fire.),

  - Human contact or injury,

  - For a small fire that hazards to human health were low since fire was put out quickly and protective gear was used for contact,

  - For a large fire that police evacuated areas downwind if there was dense black smoke; protective gear was used by contacted personnel; and liquid left from the fire and foam system was contained within the plant boundary,

- For a large fire (with F001, F002 liquids) that combustion gases were acidic and irritating; and evacuated people were treated for inhalation at hospitals, if applicable,

- Gallons of foam liquid and spill liquid recovered, yards of contaminated ground removed, and location of landfill, (The recovered liquid was used in normal processing since all wastes are compatible.).

State of Readiness

-Prepare for immediate shutdown,

-Continue running operations already started,

-Do not begin any new charges, reactions, loadings, unloadings, or startups,

-Continue state of readiness until all-clear signal is given.

Shutdown Stills at Location D

-Turn off steam to heating coils on stills,

-Stop pumping or drumming and close appropriate valves,

-Stop vacuum pumps,

-Break all electrical mains except on cooling water pump and deep well pump,

-Report to the emergency coordinator for further instructions.

Shutdown Unloading and Loading at Location A

-Stop unloading drums in box trailers,

-Be ready to move drum trailer truck immediately,

-Stop pumping drums and close appropriate valves,

-Break all electrical mains,

-Report to emergency coordinator for further instructions.

Shutdown of Tank Wagon Loading and Unloading at Location B and C

-Stop loading and unloading tank wagons and close appropriate valves,

-Disconnect hoses to tank wagons,

-Be ready to move tank wagons immediately;

-Break all electrical mains,

-Report to emergency coordinator for further instructions.

Shutdown of Additives

- Shutdown hot oil heater,
- Shutdown fume incinerator,
- Stop loading and unloading tank wagons and pumping operations and close appropriate valves,
- Be ready to move tank wagons immediately,
- Break all electrical mains except on deep well pump,
- Report to emergency coordinator for further instructions.

Shutdown of Epoxol

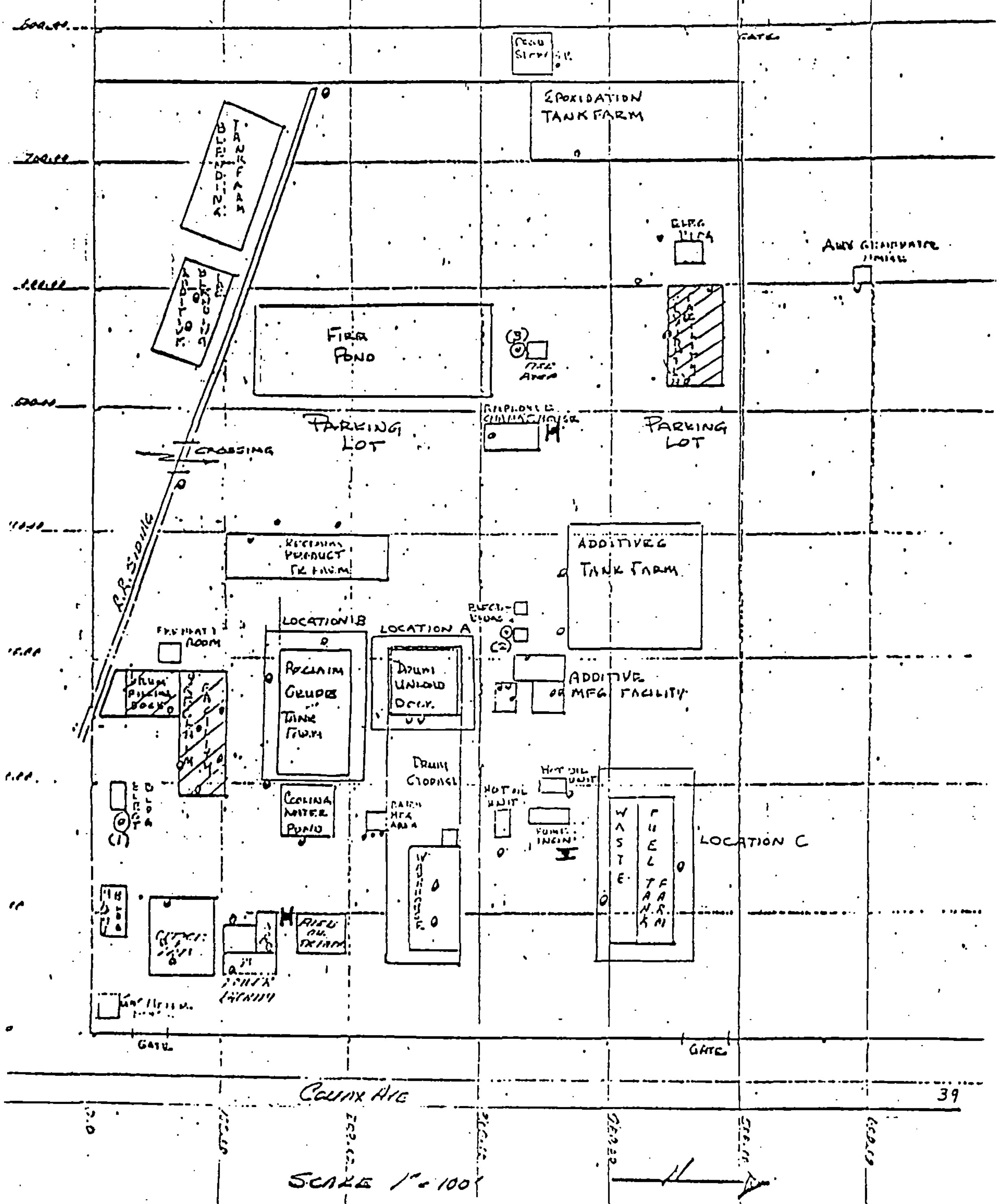
- Turn off steam to evaporator, wash tanks and reactor,
- Stop loading and unloading box trailers and tank wagons and close appropriate valves,
- Be ready to move trucks immediately,
- Stop pumping and close appropriate valves,
- Stop vacuum pump,
- Break all electrical mains except on cooling tower recirculating pump, fan, and deep well pump,
- Keep full cooling on reactor,
- Report to emergency coordinator for further instructions.

Shutdown of Barrel House

- Stop loading and unloading box trailers, tank cars, and tank wagons and close appropriate valves,
- Be ready to move trucks immediately,
- Stop drumming and pumping operations and close appropriate valves,
- Turn off steam to tank cars if heating,
- Break all electrical mains,
- Report to emergency coordinator for further instructions.

AMERICAN CHEMICAL SERVICE 1 JUNE 82

FIGURE 1



LEGEND -

• - PORTABLE HAND EXTINGUISHERS (DRY CHEMICAL 20#)

I - PORTABLE WHEEL EXTINGUISHER UNITS (DRY CHEMICAL 120#)

⊙ - STATIONARY HOSE FOAM UNITS 6%

(1) - RECLAIM - RADIUS 200' 1½ LINE

(2) - ADDITIVE - RADIUS 300' 1½ LINE

(3) - EPOXIDATION - RADIUS 260' 2½ LINE

Shutdown of Boilers

- Shutdown both boilers,
- Break all electrical mains except on the condensate pump and deep well pump,
- Report to emergency coordinator for further instructions.

Shutdown of Office and Lab

- Stop lab tests,
- Shutdown office and computer operations and leave telephones free and staff ready to accept calls,
- Report to emergency coordinator for further instructions.

Evacuation

- Follow evacuation plan in VIII,
- Reassemble at Colfax and Reder Road south of the plant and await further instructions.

IV Spill Control Plan

American Chemical Service is bordered by Colfax Avenue on the East, company railroad tracks on the South, the Grand Trunk Railroad on the North, and lowland with an elevated barrier to the West. Both the track beds of the company and the Grand Trunk are elevated above the natural terrain of the plant site and thus provide a barrier to spill flow. The roadbed of Colfax Avenue is likewise elevated and would resist flow in an easterly direction. See Figure S1 of 4.

Inside the fenced portion of the plant the hazardous waste facility is bordered by a road on the North, East, and West and by the company tracks on the South. There is a run-off system with catch basins (CB) to prevent flooding at Location A and B and unloading ramps (UR#1, UR#2). The basins empty through an inlet compartment (approximately 6000 gallons) into a holding pond with a capacity of 900,000 gallons. See Figure S2 of 4. At Location C there is a retention pond (115,000 gallon capacity) to prevent flooding of the unloading ramp (UR#3) and loading area (LA#1). Run-off water is pumped from the retention pond into the catch basin (CB) system.

Location A, the drum storage area, is a 4 ft. raised, curbed pad covered by a roof. It has a secondary containment system sufficent for the number of drums stored. All hazardous waste storage tanks in Location B and C are diked. Dimensions of the dikes are based on the Indiana Fire Marshall's Flammable Liquid Code and Allowances, Inc. Each tank containing hazardous waste is constructed to ASME specifications for the material it contains. Each is equipped with a direct reading gauge and alarm system to prevent overfilling. There are regular logged inspections of dikes, tanks, valves, and piping. Personnel are constantly aware of the dangers of a major chemical spill both as a fire and environmental threat.

New containment systems are being constructed for the hazardous waste unloading ramps (UR#1, UR#2, UR#3) with completion expected 1 September 1986. Each containment area will be large enough to hold the maximum volume of the tanker being unloaded. The retention pond adjacent to the loading area (LA#1) provides waste release containment during loading operations (capacity 24,000 gallons. The run-off system with catch basins provides emergency waste release containment with a possible phase separation through the inlet compartment (6000 gallons) which is connected to the holding pond.

V. Arrangements With Local Authorities

The town of Griffith has a disaster plan that makes provisions for dealing with emergencies at American Chemical Service. They have, in fact, activated portions of the plan over the past years. Although American Chemical Service is not specifically mentioned in the plan, it provides for various forms of assistanc The plan currently includes: traffic control, fire fighting (including arrangements with adjoining fire departments), access to Civil Defense, evacuation by the Griffith Police or Civil Defense, and arrangements with local hospitals. A copy of our contingency plan is on file at the town hall.

A meeting was held between the management of American Chemical Service and the Griffith Police Chief, Fire Chief, and assistant head of the Department of Public Works. They have expressed a willingness to consider an addition to their disaster plan to include specific emergencies that might occur at our plant. We intend to supply them with suggested response actions for these emergencies.

VI EMERGENCY COORDINATOR LIST

AMERICAN CHEMICAL SERVICE, INC.
420 South Colfax
Colfax Avenue at C & O RR.
P.O. Box 190
Griffith, Indiana 46319-0190

Telephone - Area Code (219) 924-4370

EMERGENCY COORDINATOR
JAMES MURPHY - PRIMARY
135 Holly Lane
Schererville, IN 46375

Telephone	(Home) -	(219) 322-4125
	(Work) -	(219) 924-4370
	(Beeper) -	(219) 755-2472

GEORGE MURPHY, JR.
11711 South Oakridge Drive
St. John, IN 46373

Telephone	(Home) -	(219) 365-3763
	(Work) -	(219) 924-4370
	(Beeper) -	(219) 755-2519

The listed emergency coordinators are authorized to implement all phases of the contingency plan.

VII Emergency Equipment

The list of emergency equipment is as follows:

1. Hand - held dry chemical fire extinguishers - 22 (on site)
2. Wheeled dry chemical engines - 2 (on site)
3. Foam units - 2 (on site)
4. Caterpillar tractor - front end type - 1 (on site - operator on 24 hour call)
5. Dump trucks (24 hour call)
6. Rubber tire fronted loader - backhoe - 1 (on site - operator on 24 hour call)
7. Vacuum trucks (24 hour call)
8. Portable pumps - 2 (on site)
9. Breathing apparatus and suits - 2 (on site)
10. Communications system.

1. The hand-held dry chemical fire extinguishers are ABC type. They contain 20 pounds of ABC dry chemical. Their location throughout the plant is shown in Figure 1. Hoosier Fire equipment, inc., Valparaiso, Indiana regularly maintains and annually tests and inspects these extinguishers. The hand-held units are used on small fires within three feet of the base of the flames. All units are activated by a single valve for use by one man.

2. The wheeled dry chemical engines are ABC dry chemical type. They contain 150 pounds dry chemical. The location of these two unites is shown in Figure 1. Hoosier Fire Equipment regularly maintains and annually tests and inspects these extinguishers. The engines are specifically engineered for "one man" operation. They are designed to pass through normal doorways and are maneuverable across rough or broken terrain to insure accessibility to the fire. The engines are activated by a single valve and have an integral gauge for visual inspection. When fire occures, the engines are wheeled to within approximately 40 feet upwind of the fire. The nitrogen valve is opened fully and the hose is uncoiled. The nozzle is opened and directed at the base of the flame with a side to side motion. Straight flow is used when within 10 feet of flames. The engines are designed for use on small to medium size fires.

3. The foam systems are HL-6 hand line foam nozzle type for use with National hand line foam liquid. With a water capacity of 60 GPM at 100 psi and a 6% concentration of foam liquid, the system produces 600 GPM of foam with a long range stream of 65 to 70 feet. The location and range of the two units, F1, F2, are shown on Figures 1,5. Each system has an independent source of water. When foam nozzles are used, particular care should be taken to apply the foam as gently as possible. For straight stream use, the foam should be banked off the side of a wall or other obstruction. Foam can also be rolled onto the surface by hitting the ground in front of the spill or fire. Care should be taken to minimize the mixing of the foam and fuel. The system is designed for single man operation on medium size to large chemical fires. The water source for each foam system is drawn from an individual deep well. The deep well is constructed of a 4" metal casing installed to a depth of 300 or more feet. A submersible 5 HP pump is piped to a level of 100' below grade. The rating of this system is 60 GPM at 30 psi collection tank pressure. The water is then drawn from the collection tank and pressurized to 60 GPM at 100 psi. This is done by a Fire Water Booster Pump which has a 7½ HP motor.

   Each foam system is stored with 35 gallons (7-5 gal pails) of PSL 6% AFFF Universal Foam and a shut-off Fog Nozzle for water spraying.

4. The caterpiller tractor is a front end type and is on the site 24 hours a day at the northwestern corner of plant boundary. It is owned and operated by Well, Hauling and Excavating, who is on 24 hour call. The unit is used to load contaminated ground from spills into dump trucks. (219-884-3757 and 219-755-2658 beeper)

5. Dump trucks owned and operated by Mr. Frank, Inc. are available and approved to haul contaminated ground from spills. They are on call 24 hours a day. Truck capacity us 20 yards. (See Mr. Frank, Inc. letter dated July 24, 1985. Tel 312-596-3377 and 312-785-7190)

6. A rubber tire front end loader, owned and operated by Wells, Hauling and Excavating, is on the site at the northwestern corner of the plant, and it is available 24 hours each day, and is very mobile. It is primarily used to remove contaminated ground from spills and load it into dump trucks. (219-884-3757 and 219-755-2658 beeper)

7. Vacuum trucks, capacity 5000 gallons each, are on call 24 hours each day. Mr. Frank owns and operates there trucks, which are approximately one hour travel time away from the plant. (312-596-3377 and 312-785-7190)

8. Two portable, positive displacement pumps are available to pump liquid spills. Their capacity is 90 GPM and hose lengths of 200 feet can be used. The primary pump is stored in the barrel house which is located near the southwestern corner of the plant.

9. Two breathing apparati are available in the plant. Each unit uses a compressed air cylinder. One unit with a total head covering is connected by 50 feet of hose to cylinder of breathing air. Available breathing time per cylinder is 30 minutes. This cylinder cart is stored in reclaim building at southern end of plant. The other unit with face covering if totally self-contained, and has an available breathing time of 15 minutes. This unit is stored in the maintenance office. Complete poly coated body suits are available with each unit. They are both OSHA approved.

10. The communications system consists of seven phones placed in areas throughout the plant. Four phones are capable of interplant communications only. They are located in the reclaim, (Location D), additive manufacturing, epoxidation, and barrel house sections. The other three phones can be used for interplant or outside calls. They are located in the lab safety office (warehouse), and change room. Dial 71 on intercom phone line turns on three sirens which are located at the office, change room and epoxidation facility.

VIII Evacuation Plan

The evacuation plan for plant personnel is as follows:

- -Location A, Additives and Epoxol - Head southwest (south for Epoxol) to the south gate cross the railroad tracks, go east to Colfax, then south to Reder Road and wait; or head west to the west gate, then south across the railroad tracks, go east to Colfax, then south to Reder Road and wait;

- -Location B, Location D and Barrel House - Head south to the railroad gate, (south gate for Barrel House) cross the tracks, go east to Colfax, then south to Reder Road and wait; or head east to the southeast gate to Colfax, then south to Reder Road and wait;

- -Location C - Head north to the north gate to Colfax, then south to Reder Road and wait; or head west to the west gate, then south across the railroad tracks, go east to Colfax, then south to Reder Road and wait;

- -Office, Maintenance and Warehouse - Head southeast to the southeast gate to Colfax, then south to Reder Road and wait; or head southwest to railroad gate, cross the tracks, go east to Colfax, then south to Reder Road and wait.

The Emergency coordinator must account for all personnel at the meeting point (Colfax and Reder Road).

IX Emergency Procedures

The contents of the emergency procedures indicate what observations, indentifications, assessments, and decisions the emergency coordinator must make during an emergency in order to direct plant personnel to the correct response actions.

a) The emergency coordinator is notified, called or beeped by plant personnel for:

   1) A minor spill of hazardous material greater than 5 gallons outside a containment area,

   2) A major spill of hazardous material,

   3) A fire or explosion involving hazardous material

   The emergency coordinator gets the location from the reporting personnel and:

   1) For a minor or major spill he orders shutdown of the sections within 50 feet of the spill and a state of readiness for the rest of the plant (If a section is shutdown he dials 71 on intercom to sound the plant alarm).

   2) For a fire or explosion he orders shutdown of section within 100 feet of fire and state of readiness for rest of plant(If a fire is large he orders shutdown of all sections and sounds plant alarm by dialing 71 on intercom). Shutdown procedures for all sections are on pages 16-18.

   Local agencies have no immediate response role. They are notified later if they are needed.

b) The emergency coordinator then goes to the scene of the emergency. He:

   1) Inspects the spill, fire or explosion, nearby tanks, drums, tank wagons and spark sources;

   2) Estimates gallons of material involved and the size of the emergency;

   3) Determines the exact source (i.e. drum, tank or tank wagon);

   4) Consults daily tank log, hazardous drum label or tank wagon manifest to identify the makeup of materials (He knows that all hazardous wastes accepted at the plant are compatible. They are flammable liquids (D001, D003, F005) and spent liquid halogenated solvents (F001, F002). They require a protective suit and a breathing apparatus for contact.);

c) He:

1) Checks human contact or injury, accounts for personnel, and tells them to:

   i) wash contacted area of body,

   ii) change clothing

   iii) visit Hammond Clinic for injury or if material was taken internally.

2) Removes personnel upwind to a distance of:

   i) 20 feet - small spill,

   ii) 40 feet - large spill,

   iii) 40 feet - small fire

   iv) 100 feet - large fire or explosion.

3) For spills he must:

   i) confirm that spill is contained, stagnant and no threat by walking around perimeter of spill,

   ii) shut off line from holding pond to sewer if spill reaches the inlet compartment.

4) For fire or expolsion he must:

   i) check smoke from fire (Dense black smoke indicates a large amount of organic loading. Do not let personnel breathe smoke. For fires with F001, F002 liquids, combustion gases are acidic and irritiating. A protective suit and breathing apparatus are available for contact.),

   ii) check direction that the smoke is heading,

   iii) check for the spreading of foam liquid while fighting the fire (It must not leave plant boundary.)

   iv) watch tanks near the fire (Heavy venting from the tank vent means rapid heating. An explosion could follow.),

d) For a large fire or expolsion he notifies the Griffith Police to:

1) Block the intersections at Colfax and Main, Colfax and Reder allowing only emergency vehicles to pass,

2) Evacuate areas of Griffith downwind if dense black smoke or vapor releases are leaving the plant boundary (For F001, F002 liquids, combustion gases are acidic and irritating. Tell people to seek medical attention for inhalation.),

3) Call Hammond Clinic that people from Griffith may require medical attention for inhalation of acidic gases,

4) Notify Griffith Police when fire is out, to remove roadblocks, and to reinhabit evacuated areas when air is clear.

He call the National Response Center (800-424-8802) and report

1) James Murphy or other emergency coordinator and 219-924-4370
2) American Chemical Service, Inc.
420 S. Colfax
Griffith, Indiana 46319,
3) Time and word "Spill or Fire",
4) Makeup of spill or fire (i.e. D001) and gallons,
5) Human contact or injury,
6) For spills that hazards to human health are low since spill is contained within plant boundary and protective gear is available for contact,
7) For large fires or explosions that police are to evacuate areas downwind if there is dense black smoke or vapor releases, that protective gear is available when fighting fire, and that liquid from the spill and foam system is contained within the plant boundary (For F001, F002 liqui combustion gases are acidic and irritating and evacuated people may require medical attention for inhalation.),
8) For other fires that hazards are low since fire is being put out quickly and protective gear is available for conta

e) For spills and fires refer to part (a) for areas shutdown. For a spill he must:

1) Keep cars, tractors, trucks, etc at least 40 feet away,

2) Order shutdown of spark sources within 60 feet (i.e.fume incinerator, hot oil heater, or boiler),

3) Place fire fighting equipment (i.e. dry chemical engines and foam system) within 40 feet,

4) Pump free liquid on ground to a storage tank in Location B or C (This includes contaminated ground water. All hazardous wastes are compatible.),

5) Check that spill is not spreading by walking the perimete of the spill area,

6) Skim liquid from inlet compartment of holding pond to a storage tank, if applicable, and sample water left in pond (In general hazardous wastes accepted at the plant have a low water solubility.),

7) Pump contents of drum, tank, or tank wagon to a storage tank if the container continues to leak,

8) Use Mr. Frank vacuum trucks if spill is beyond reach of the portable pump system,

9) Remove portable pump and hoses to drum storage area,

10) Rope off area after liquid is removed until ground cleanup begins,

11) Check area frequently,

12) Remove contaminated ground with a front end loader-backhoe (Wells, Hauling and Excavating) and dump trucks (Mr. Frank, Inc.),

13) Inspect area when digging is completed to make sure that no contaminated ground remains.

For a fire or explosion he must:

1) Order tank wagons and box trailer trucks not involved in fire to move away or leave the plant (Keep trucks at least 100 feet away.),

2) Put out a small fire with a hand-held fire extinguisher,

3) Put out a moderate fire with a dry chemical engine,

4) Put out a large fire with Foam System F1, F2,

   i) For location A - use F2,

   ii) For Location B - use F1, F2,

   iii) For Location C - use F2.

5) Know the capabilities of each fire fighting system (For details see Emergency Equipment VII - 1,2,3),

6) Check if fire is spreading or abating,

7) Draw back to a new fire line to protect other portions of the plant if the fire is spreading,

8) Do not let fire jump the fire fighting line,

9) Use Griffith Fire Department to fight building or brush fires. (They have conventional equipment. Do not put plain water on a chemical fire since the fuel floats on water.),

10) Determine when fire is out (Leave no smoldering areas.),

11) Check that foam liquid and spill remaining is not moving and is contained,

12) Check fire area frequently to make sure that it does not restart,

13) Release Griffith Fire Department,

14) Follow steps 4 through 13 (part (e) for spills) to remove foam liquid, spill liquid left from fire, and contaminated ground.

f) During the spill or fire emergency he must:

1) Check shutdown section every hour and:

i) check temperatures of reactors, process tanks, fume incinerator, hot oil heater, and boiler,

ii) check deep wells, cooling water pumps, and boiler condensate pump,

iii) check pressure on boiler and plant steam lines.

2) Check the following in area affected by spill or fire:

i) tank, tank wagons and drums,

ii) valves, pipes, hoses, and filters,

iii) tank gauges and pressure gauges.

g) The emergency coordinator must:

1) Call Mr. Frank, Inc. (312-596-3377) to obtain an Emergency Spill Permit with C.I.D. to dispose of the contaminated ground,

2) Store scrapings and soiled protective clothing in open-head drums at the drum storage area until they are hauled to a secure landfill (Scrapings are collected during the cleaning of shovels and the front end loader.),

3) Pump flushings of solvent used to clean the portable pump and hoses to a storage tank in Location B or C,

4) Check that liquids recovered from the spill and flush solvents used for cleaning are processed normally in Location C.

h) He must:

1) Know that all wastes accepted at the plant are compatible with the spill liquid,

2) Inspect emergency equipment to make sure that it is ready for another emergency and:

i) all equipment must be clean and at the proper storage location

ii) spent fire fighting equipment must be recharged or replaced.

i) He notifies the Regional Administrator (800-424-8802) and Indiana Response Center(317-633-0144) that:

1) No incompatible wastes are stored at plant,

2) All emergency equipment is ready for another emergency,

3) Normal operations in rest of plant are ready to be resumed,

4) The affected section of the plant will not startup until the damaged operations equipment is fixed or isolated from use.

j) He enters time, date, and details of spill or fire in the operating log. Within 15 days he must file a written report to the Regional Administrator stating:

1) James Murphy - owner-operator
135 Holly Lane
Schererville, IN 46375

2) American Chemical Service, Inc. - facility
420 South Colfax
Griffith, Indiana 46319

3) Date, time and word "Spill" or "Fire",

4) Makeup of spill or fire (i.e. D001) and gallons,

5) Human contact or injury,

6) Hazards at the plant were low since protective gear was available where there was contact and:

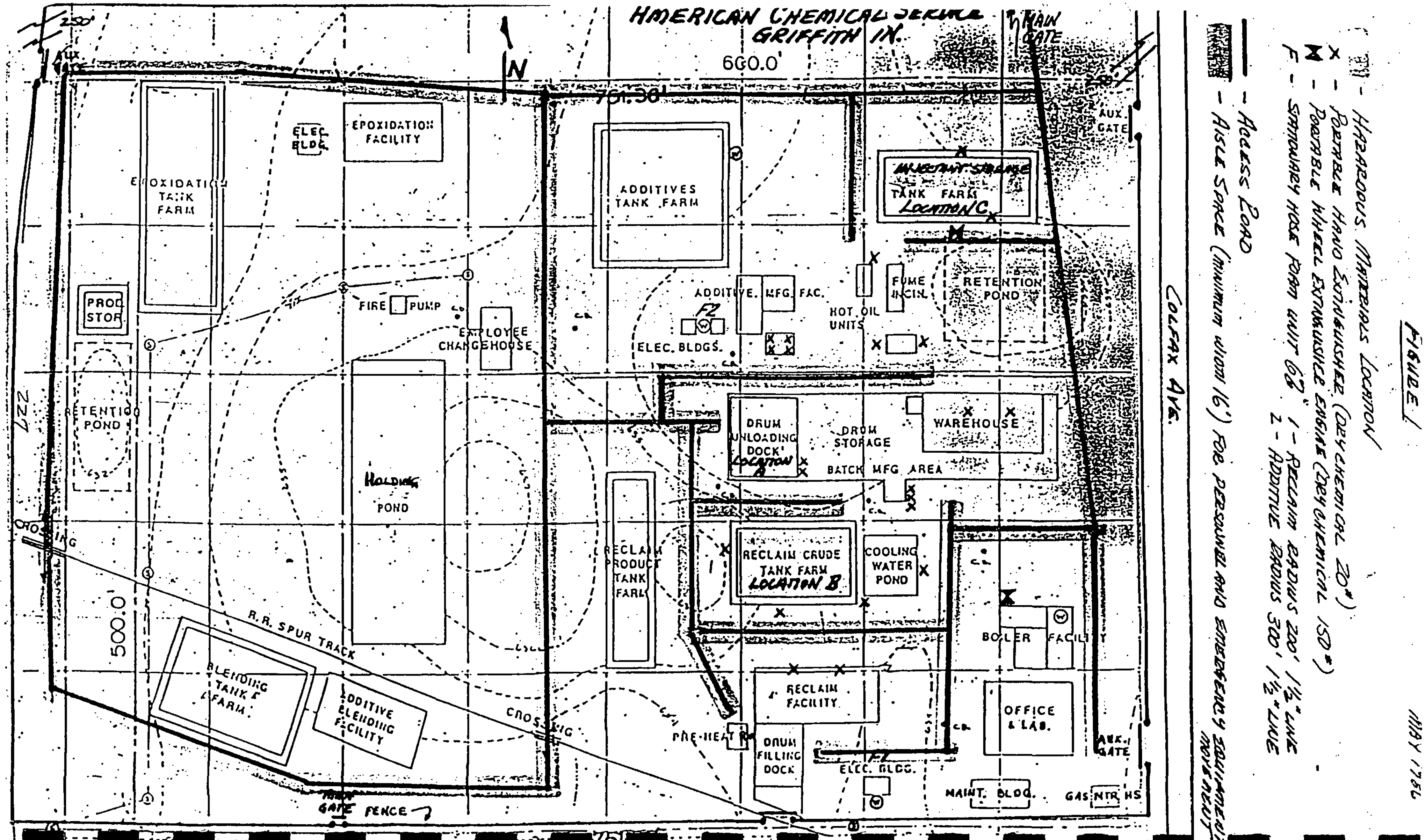
i) for spills the liquid was contained within the plant boundary,

ii) for a small fire vapor releases were low since the fire was put out quickly,

iii) for large fires the police evacuated areas downwind if there was dense black smoke; and the liquid left from the foam system and the fire was contained within the plant boundary,

iv) for a large fire (with F001, F002 liquids) the combustion gases were acidic and irritating; evacuate people were treated for inhalation at a hospital, if applicable,

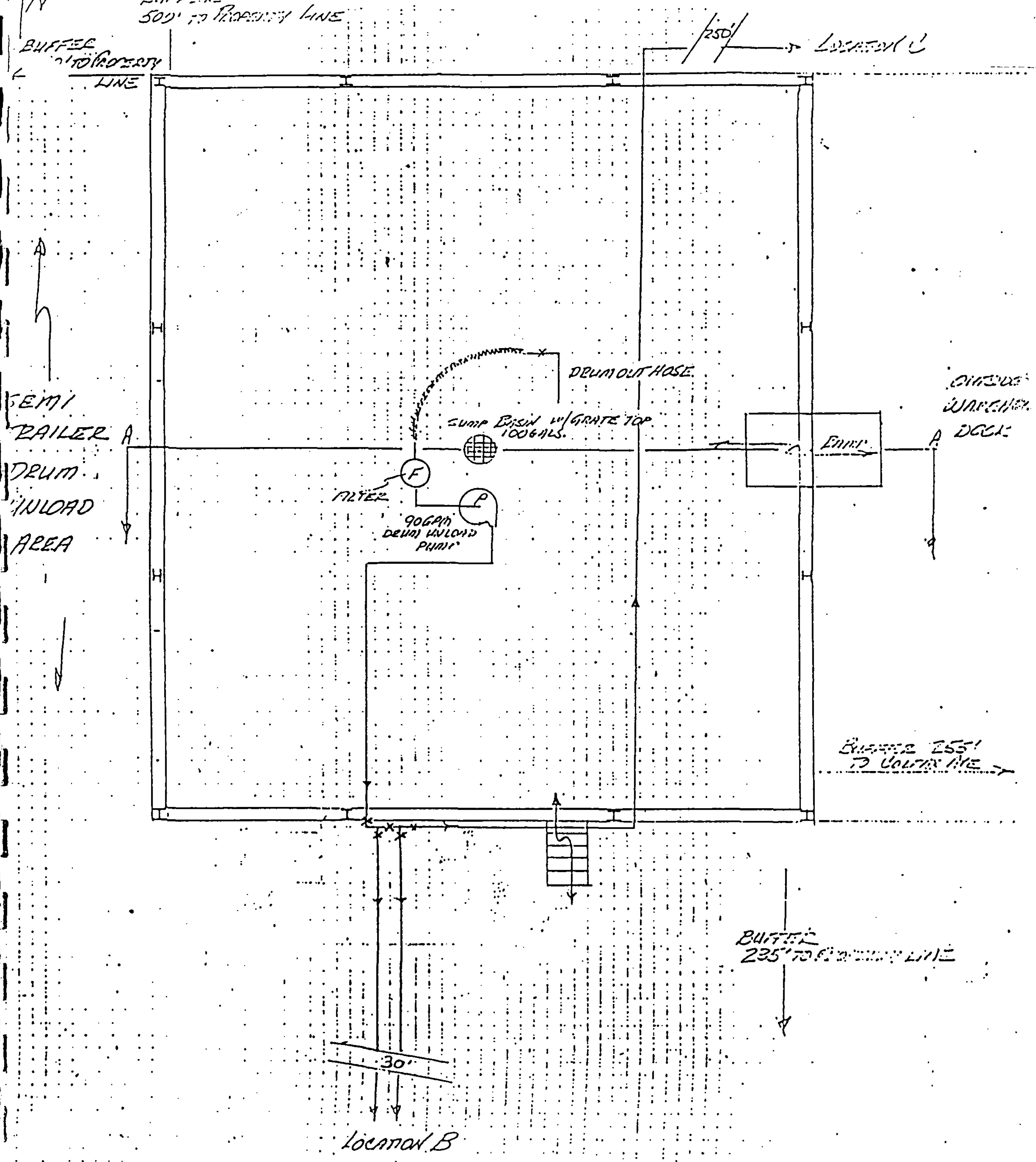
7) Gallons of foam liquid and spill liquid recovered, yards of contaminated ground removed, and location of landfill (The recovered liquid was used in normal processing since all wastes are compatible.).



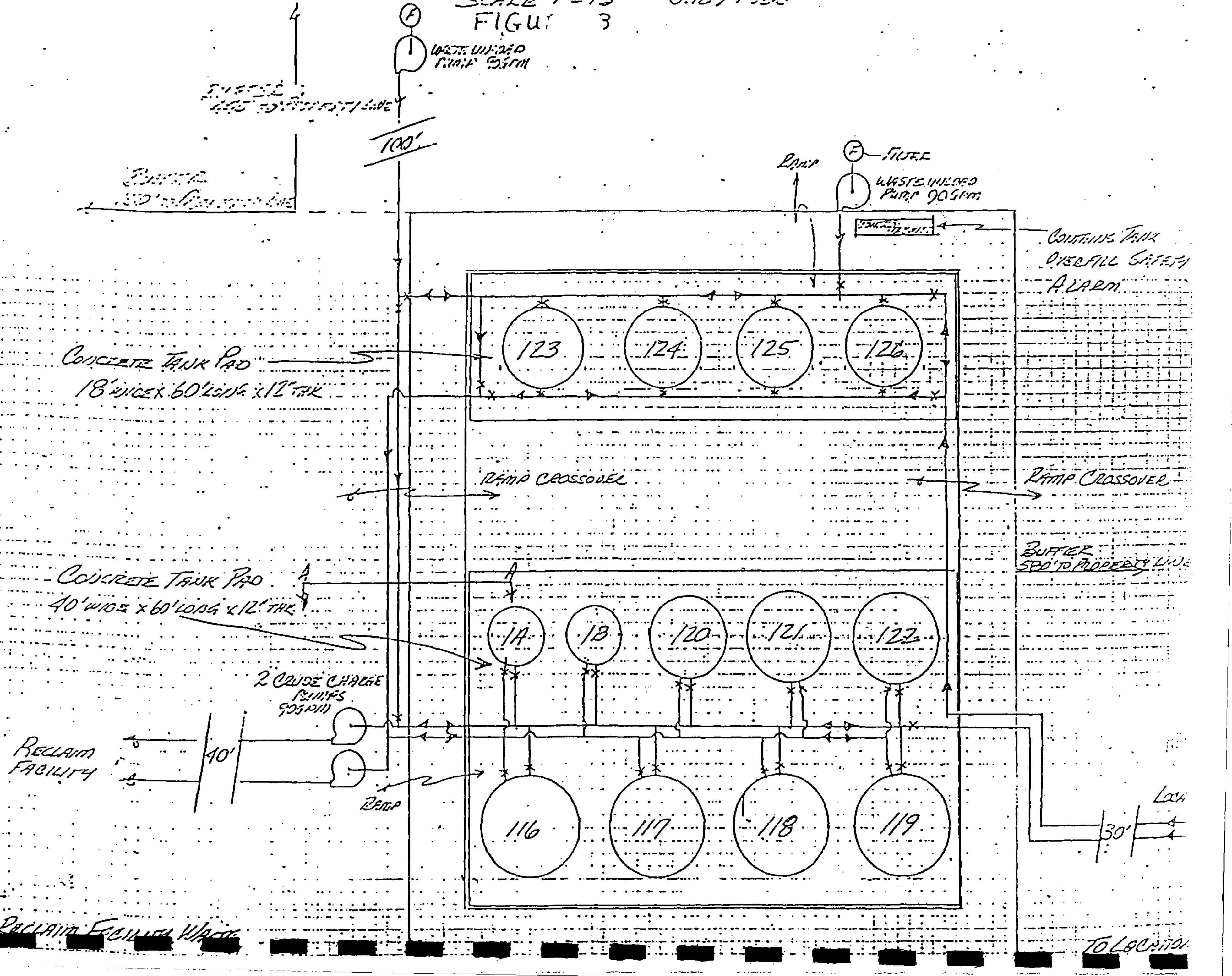
AMERICAN CHEMICAL SERVICE
GRIFFITH IN.
N
MAIN GATE
AUX GATE
600.0'
761.30'
500.0'
751
EPOXIDATION FACILITY
ELEC. BLDG.
EPOXIDATION TANK FARM
ADDITIVES TANK FARM
SOLVENT STORAGE TANK FARM
LOCATION C
PROD STOR
FIRE PUMP
EMPLOYEE CHANGEHOUSE
ADDITIVE MFG. FAC.
HOT OIL UNITS
FUME INCIN.
RETENTION POND
ELEC. BLDGS.
RETENTION POND
HOLDING POND
DRUM UNLOADING DOCK
LOCATION A
DRUM STORAGE
WAREHOUSE
BATCH MFG AREA
RECLAIM PRODUCT TANK FARM
RECLAIM CRUDE TANK FARM
LOCATION B
COOLING WATER POND
BOILER FACILITY
CROSSING
R.R. SPUR TRACK
BLENDING TANK FARM
ADDITIVE BLENDING FACILITY
RECLAIM FACILITY
PRE-HEAT
DRUM FILLING DOCK
ELEC. BLDG.
OFFICE & LAB.
AUX. GATE
MAINT. BLDG.
GAS MTR HS
MAIN GATE
FENCE
COLFAX AVE.
FIGURE 1
MAY 1986
- HAZARDOUS MATERIALS LOCATION
X - PORTABLE HAND EXTINGUISHER (DRY CHEMICAL 20#)
- PORTABLE WHEEL EXTINGUISHER ENGINE (DRY CHEMICAL 150#)
F - STATIONARY HOSE FOAM UNIT 6" 1 - RECLAIM RADIUS 200' 1 1/2" LINE
2 - ADDITIVE RADIUS 300' 1 1/2" LINE
- ACCESS ROAD
- AISLE SPACE (MINIMUM WIDTH 16') FOR PERSONNEL AND EMERGENCY EQUIPMENT MOVEMENT

SCALE 1"=10' JULY 1985

FIGURE 2

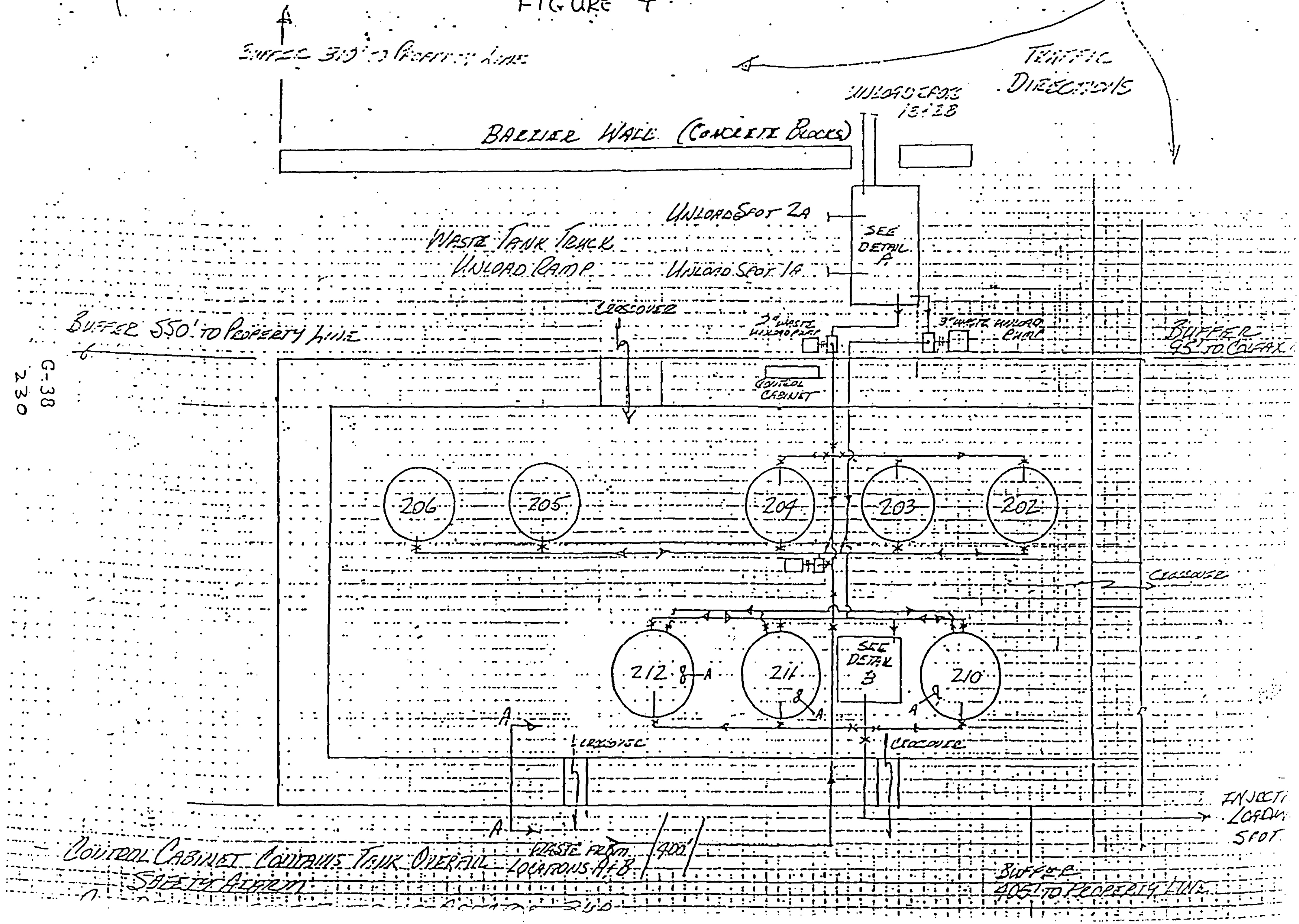


SCALE 1 = 15'
FIGU 3



SCALE 1"=13' 1985

FIGURE 4



G-38
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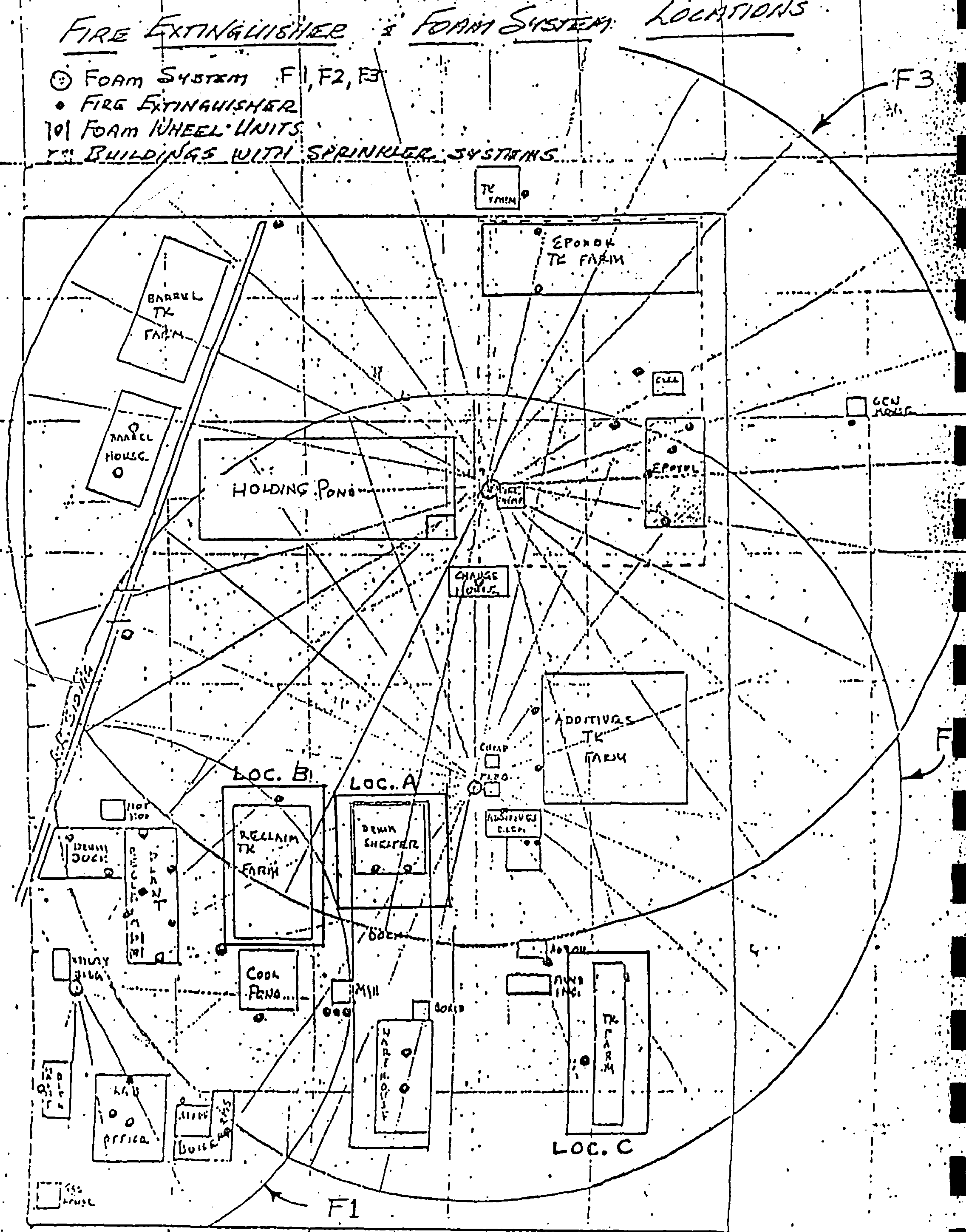
FIGURE 5


FIRE EXTINGUISHER & FOAM SYSTEM LOCATIONS
Foam System F1, F2, F3
Fire Extinguisher
Foam Wheel Units
Buildings with Sprinkler Systems
F3
TK FARM
EPOXOL TK FARM
BARREL TK FARM
BARREL HOUSE
HOLDING POND
EPOXOL
GEN HOUSE
CHANGE HOUSE
ADDITIVES TK FARM
LOC. B
LOC. A
RECLAIM TK FARM
DRUM SHELTER
ADDITIVES ELEM
DRUM DOCK
PLANT
COOL POND
MILL
DOCK
WAREHOUSE
TK FARM
LOC. C
LAB
OFFICE
F1
F

INDUSTRIAL DISPOSAL
MR. FRANK INC.

July 24, 1985

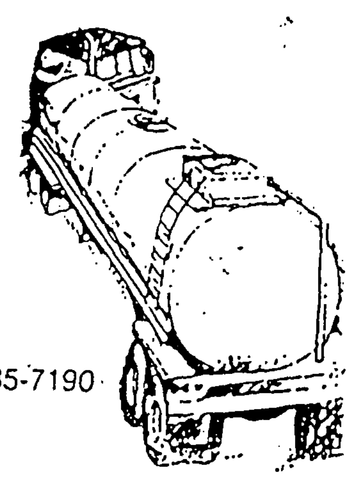
Mr. Jim Tarpo
American Chemical Service
Colfax Avenue C&O Railroad
Griffith, Indiana 46319

Re: Emergency Contingency Plan

Dear Jim:

Mr. Frank, Inc. is pleased to have this opportunity to help you establish an emergancy contingency plan. We offer you the following:

1. Proper equipment to pick up free liquids which have spilled.
   a. Equipment availible (24) twenty-four hours per day.
   b. Equipment availible seven (7) days per week.
2. Proper equipment for transporting contaminated soil from spills of the following listed wastes.
   a. F001
   b. F002
   c. F003
   d. F005
3. Contacted C.I.D. regarding emergancy spills.
   a. Expect emergancy permit within twenty-four (24) hours via phone conversations.
   b. Must contact Indiana Response Group, Illinois Emergancy Response Group, National Emergancy Response Group.
4. Criteria for disposal in bulk.
   a. No absorbants added.
   b. No free liquids.
   c. Passes test as non-ignitable solid.
5. Approximate Disposal Costs - BULK
   a. Transportation and disposal per 20 yd. truck load.........$1,900.00
   b. Disposal costs subject to change with little notice.



201 West 155th Street • South Holland, Illinois 60473 • (312)596-3377 • (312)785-7190

INDUSTRIAL DISPOSAL
MR. FRANK INC.

Jim, as always, all work performed by Mr. Frank, Inc. will be in strict compliance of all federal, state and local laws rules and regulations.

Should you have any questions, please feel free to contact us at anytime.

Sincerely:

Dennis

Dennis P. Herrle
Sales Representative

DPH/slh

WELLS HAULING AND EXCAVATING
P.O. Box 407
Griffith, IN 46319
219-884-3757
219-755-2658 Beeper

August 15, 1985

Mr. James Tarpo
American Chemical Service, Inc.
420 South Colfax
Griffith, Indiana 46319

Re: Contingency Plan

Dear Mr. Tarpo:

Wells Hauling and Excavating will make available to you for your contingency plan the following equipment:

1) 1-Rubber tire front end loader-backhoe with operator
   a) availability-24 hours per day, 7 days per week
   b) storage-northwest corner of American Chemical plant site.

2) 1-Caterpillar Tractor-front end type with operator
   a) availability-24 hours per day, 7 days a week
   b) storage-northwest corner of American Chemical plant site.

I am familiar with procedures required by your company to handle hazardous wastes.

Our company has had a good working relationship with you for the past 19 years.

Sincerely,

Ricky A. Baldner

Rick Baldner
Owner-Operator

RB/rl

Training for Emergency Response

The contingency plan instructs plant personnel to respond effectively to emergencies at the direction of the emergency coordinator.

Procedures for using emergency and monitoring equipment, communications and alarm systems, response to spills and fires, shutdown of operations and evacuation are outlined in the personnel training. The personnel training is conducted on an annual basis with additional training sessions scheduled periodically for changes and updating.

Through training, employee feedback and reference to regulation and technical inovations the Contingency Plan of ACS will be subject to constant updating. The major responsibility for the updating will be with the management of ACS with input from the ACS Safety Committee and the Site Safety and Health Officer.

The employees will be made aware of changes to the Contingency Plan with scheduled training sessions. All sessions will be documented with the following;

1. Date
2. Subject
3. Location
4. Instructor
5. Employee - Name and signature

Relevance of Training to Job Position

The Site Safety and Health Officer observes each employee performing the routine procedures for handling hazardous wastes on the job. If he observes any improper procedures, he notifies the supervisor in charge to instruct the employee about the proper ones to follow.

He also periodically asks the employee what he would do if he obseved a spill, fire or explosion involving hazardous waste. The employee must reply that he would notify, beep, or call the emergency coordinator, and then follow his instructions.

If the Site Safety and Health Officer becomes aware of a misunderstanding or complacency concerning the contingency plan, he will notify the management and more mandatory training will be scheduled.

Implementation of Training Program

Facility personnel have completed the training program. Records documenting the required training are on file at the ACS facility.

SECTION K:

CONFINED SPACE ENTRY PROCEDURES

K.) Confined Space Entry Procedure:

This section addresses the requirement to develop a program to protect the employees when making an entrance into a confined space. As mentioned in Section C, ACS has in place a Hazardous Atmosphere Entry Program (Copy enclosed). All confined space entries made at ACS are considered hazardous until the procedure described in the program has it proven otherwise. The following page (K-1) is the checklist used by the Plant Safety Coordinator to determine the condition of the confined space.

Items D and J are measured with the following instruments:

1.) Oxygen Deficiency Levels:
Model MX241 Oxygen Monitor

2.) Combustion Levels (LEL):
Model MX241 Combustible Gas Monitor

SITE SAFETY AND HEALTH OFFICER CHECKLIST

A.) Date:

B.) Description of Entry and Purpose:

C.) Toxicity Levels: (Based on last materials in space)

<u>Substance</u> <u>TWA</u> <u>STEL</u>

Reference 29 CFR Part 1910 Sub Part Z

D.) Last Material in the space ______________________________

Run short duration toxic tube for toxic substances _____, _____ppm

_____, _____ppm

E.) Oxygen Deficiency Levels: (Below 19.5%)

F.) Combustion Levels: (Above 22% LEL)

G.) Electrical switch gear: (Main shutoff and locked out)

H.) Nitrogen purge: (Disconnect Piping or Tubing)

I.) Lighting: (is it adequate and if not use explosion proof lamp)

J.) Temperature of the Atmosphere: (Below 100°F)

K.) Support tools to be used: (Sparkproof)

L.) Has the entry Personnel received Hazardous Atmosphere Entry Training? YES NO

If NO, the Personnel must be replaced.

M.) Errant Liquid or Gas entry: (Disconnect Piping or lock valves)

N.) Supervisor in charge:

O.) Issue Hazardous Atmosphere Entry Form:

P.) Review Hazardous Atmosphere Entry Form and brief workers of the potential hazards.

Q.) Signals:

1.) THUMB UP - OK
2.) THUMB DOWN - NOT OK
3.) BOTH HANDS CROSSED ON THE CHEST - NEED MORE AIR
4.) POINT DOWN - INSIDE MAN NEEDS ASSISTANCE
5.) HORN BLAST - INSIDE MAN MUST EVACUATE

R.) Signoff:

______________________________ ______________

Site Safety and Health Officer Date

HAZARDOUS ATMOSPHERE ENTRY FORM
FOR SCHEDULED ENTRIES

Date:
..) Entry Description and Purpose:
3.) Plant Manager Approval:
4.) Equipment to be used:

3 M Hose Mask (White Cap)________
MSA Air Mask (SCBA)________
ARAP w/Escape________
Suit Alert________
Chemrel C-106________
Harness________
#5414 Poly Coated Tyvek Coveralls________
SF 8512 Gaunt Vinyl Gloves________
Lineman's Rubber Boots________
Fire Extinguisher 20# Dry Chemical________
Sparkproof Support Tools________
Air Horn________

5.) Entry Personnel:

Entry Man________
Backup Man________

6.) Time of entry:
7.) Time of completion:
8.) Checklist:

ITEM	ACTION	INITIAL
A.) Prior equipment inspection		
B.) Breathing Air Cylinder Pressure #1		
Breathing Air Cylinder Pressure #2		
C.) Prior Air Mask (SCBA) Cylinder Pressure		
D.) Prior ARAP Escape Cylinder Pressure		
E.) Hose Mask (White Cap) Regulator Setting (20-30 psi)		
F.) Hose Mask (White Cap) Flowmeter Setting (30%)		
G.) ARAP Hose Mask Pressure Setting (80 to 100 psi)		
H.) After use Equipment Inspection		
I.) After Breathing Air Cylinder Pressure #1		
After Breathing Air Cylinder Pressure #2		
J.) After Air Mask (SCBA) Cylinder Pressure		
K.) After ARAP Escape Cylinder Pressure		

9.) Equipment Problems or Comments:

Re n to Site Safety and Health Officer

APPENDIX E

HNu CALIBRATION PROCEDURES

8.2 CALIBRATION CHECKING WITH ISOBUTYLENE

The calibration of the analyzer can be rapidly checked by the use of an HNU small disposable cylinder containing isobutylene (HNU pn 101-350) with a regulator (HNU pn 101-351).

At the factory, the analyzer is first calibrated on the desired gas standard at the specified concentration. Then a measurement is made with isobutylene.

The ppm reading along with the span setting using isobutylene is recorded in the calibration report.

In service, the analyzer calibration can be checked and readjusted if necessary by using this cylinder and regulator as follows:

a. Connect the analyzer to the regulator and cylinder with a short piece (butt connection) of tubing as shown in Figure 8-1. The calibration gas in the cylinder consists of a mixture of isobutylene and zero air. Isobutylene is nontoxic and safe to use in confined areas. There are no listed exposure levels at any concentration.
The regulator sets and controls the flow rate of gas at a value preset at the factory. This will be about 250 cc/min.
It is important that the tubing be clean since contaminated tubing will effect the calibration reading. Do not use the cylinder below about 30 psig as readings below that level can deviate up to 10% from the rated value.
Safely discard the disposable cylinder when empty. Do not refill this cylinder.
It is against the law to transport refilled cylinders.

b. With the SPAN setting and the function switch at the same positions as listed in the Application Data Sheet or Calibration Report, open the valve on the cylinder until a steady reading is obtained.

c. If the reading is the same as the recorded data, the analyzer calibration for the original species of interest is still correct.

d. If the reading has changed, adjust the SPAN setting until the reading is the same.

e. Shut off the cylinder as soon as the reading is established.

f. Record and maintain this new SPAN setting. Then recalibrate the analyzer on the species of interest as soon as possible.

g. Whenever the analyzer is recalibrated, it is to be immediately checked with the small cylinder and the reading recorded. This can then be used for later checking in the field.

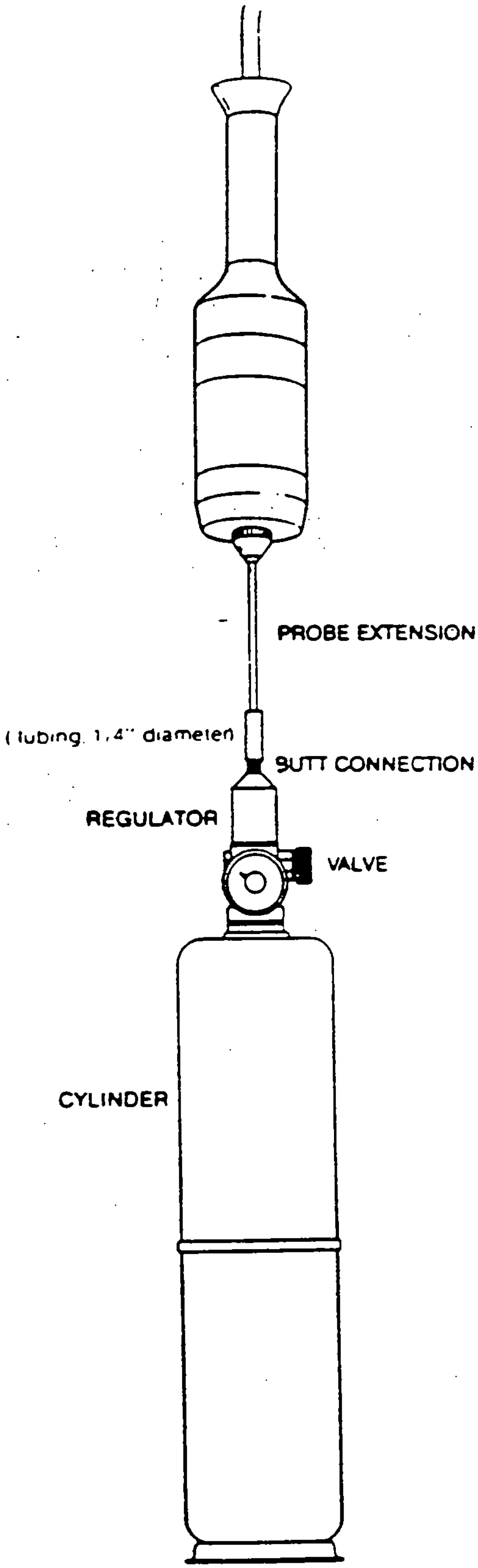


FIGURE 8-1
CALIBRATION CHECKING SET-UP

8.3 CALIBRATION WITH ALTERNATE GAS

If a calibration standard with the same trace gas as that to be measured is not available or is hazardous, it is possible to use an alternate calibration gas. (Note : This technique may not be as accurate as calibration with the species of interest.) In this case, the expected reading for calibration must be compensated for the difference between the two gases. In operation, the meter will then give a direct reading of the gas being measured.

This calibration is illustrated in the following examples: (PS = Photoionization Sensitivity. See Table 8-14)

a. Given a case in which:

1) The trace gas to be measured is Vinyl Chloride (PS = 5.0)

2) The calibration gas to be used is Isobutylene (PS = 7.0) at a 100 ppm level

What is the ppm reading to be when calibrating to give a direct reading when measuring Vinyl Chloride?

The required reading for calibration will be:

$$= \text{Isobutylene ppm} \times \frac{\text{PS(Isob)}}{\text{PS(Vin Chlor)}}$$

$$= 100 \times \frac{7.0}{5.0}$$

$$= 140 \text{ ppm}$$

In this example, using a calibration gas with 100 ppm of Isobutylene, adjust the SPAN control so the meter reads 140 ppm. In operation, the instrument will then give a direct reading of the ppm of Vinyl Chloride.

b. Given a case in which:

1) The trace gas to be measured is Benzene (PS = 10.0)

2) The calibration gas to be used is Isobutylene (PS = 7.0) at a level of 100 ppm

3) What is the ppm reading to be when calibrating to give a direct reading when measuring Benzene.

The required reading for calibration will be:

$$= \text{Isobutylene ppm} \times \frac{PS(Isob)}{PS(Benzene)}$$

$$= 100 \times \frac{7.0}{10.0}$$

$$= 70.0 \text{ ppm}$$

In this example, using a calibration gas with 100 ppm of Isobutylene, adjust the SPAN control so the meter reads 70 ppm. In operation, the instrument will then give a direct reading of the ppm of Benzene.

c. Given a case in which:

1) The trace gas to be measured is H2S (PS = 2.8)

2) The level of H2S for which it is to be calibrated is 60 ppm.

3) The calibration gas available is Isobutylene (PS = 7.0)

4) What ppm level of Isobutylene is required to permit direct reading of H2S, calibrating at its 60 ppm level.

The required Isobutylene level for calibration will be:

$$= H2S \text{ ppm} \times \frac{PS(H2S)}{PS(Isob)}$$

$$= 60 \times \frac{2.8}{7.0}$$

$$= 24.0 \text{ ppm}$$

In this example, using a calibration gas with 24.0 ppm of Isobutylene, adjust the SPAN control so the meter reads 60 ppm. In operation, the instrument will then give a direct reading of the ppm of H2S.

Care is to be taken when working with flammable gas samples to stay below the Lower Explosive Limit (LEL) and with hazardous or toxic gases to stay below the Threshold Limit Value (TLV) safe working level.

If difficulties are encountered in calibration, the user should consult the local HNU representative.

APPENDIX F

CERTIFICATION REGARDING POTENTIAL RELEASES FROM SOLID WASTE MANAGEMENT UNITS

Attachment 2

CERTIFICATION REGARDING POTENTIAL RELEASES FROM
SOLID WASTE MANAGEMENT UNITS
(CLOSURE PLAN REVIEW)

FACILITY NAME: American Chemical Service, Inc.

EPA I.D. NUMBER: IND 016360265

LOCATION CITY: 420 S. Colfax Ave. Griffith

STATE: Indiana

1. Are there any of the following solid waste management units (existing or closed) at your facility? **NOTE - DO NOT INCLUDE HAZARDOUS WASTES UNITS CURRENTLY SHOWN IN YOUR PART A APPLICATION AND IN YOUR CLOSURE PLAN.**

	YES	NO
• Landfill	X	
• Surface Impoundment	X	
• Land Farm		X
• Waste Pile		X
• Incinerator	X	
• Storage Tank (Above Ground)		X
• Storage Tank (Underground)		X
• Container Storage Area	X	
• Injection Wells		X
• Wastewater Treatment Units	X	
• Transfer Stations	X	
• Waste Recycling Operations	X	
• Waste Treatment, Detoxification		X
• Other ____________		

2. If there are YES answers to any of the items in Number 1 above, please provide a description of the wastes that were stored, treated or disposed of in each unit. In particular, please focus on whether or not the wastes would be considered as hazardous wastes or hazardous constituents under RCRA. Also include any available data on quantities or volume of wastes disposed on and the dates of disposal. Please also provide a description of each unit and include capacity, dimensions, location at facility, provide a site plan if available.

ference American Chemical Service, Inc. response dated Jan 18, 1985 to U.S. EPA
ERCLA Sec. 104 Request for Information dated Oct 18, 1984 and the
emedial Investigation for the ACS NPL Site conducted by Warzyn.

NOTE: Hazardous waste are those identified in 40 CFR 261. Hazardous constituents are those listed in Appendix VIII of 40 CFR Part 261.

3. For the units noted in Number 1 above and also those hazardous waste units in your Part A Application and in your closure plan. Please describe for each unit any data available on any prior or current releases of hazardous wastes or constituents to the environment that may have occurred in the part or still be occurring.

Please provide the following information:

a. Date of release
b. Type of waste released
c. Quantity or volume of waste released
d. Describe nature of release (i.e., spill, overflow, ruptured pipe or tank, etc.)

ference American Chemical Service, Inc. response dated Jan 18, 1985 to U.S. EPA
ERCLA Sec. 104 Request for Information dated Oct 18, 1984 and the
emedial Investigation for the ACS NPL Site conducted by Warzyn.

4. In regard to the prior releases described in Number 3 above, please provide (for each unit) any analytical data that may be available which would describe the nature and extent of environmental contamination that exists as a result of such releases, please focus on concentrations of hazardous wastes or constituents present in contaminated soil or groundwater.

ference American Chemical Service, Inc. response dated Jan 18, 1985 to U.S. EPA
CLA Sec. 104 Request for Information dated Oct 18, 1984 and the
emedial Investigation for the ACS NPL Site conducted by Warzyn.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the submittal is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalities for submitting false information, including the possibility of fine and imprisonment for knowing violations. (42 U.S.C. 6902 et seq. and 40 CFR 270.11(d))

John Murphy, Vice President
Type Name and Title

John Murphy
Signature

9/26/90
Date

APPENDIX G

FINANCIAL ASSURANCE FOR CLOSURE

american Chemical Service, Inc.
P.O. Box 190 • Griffith, Indiana 46319
(219) 924-4370 • Chicago Phone (312) 768-3400

September 27, 1990

Mr. Jeffrey W. Stevens
Solid and Hazardous Waste Management
Indiana Dept. of Environmental Mgmt.
P.O. Box 6015
Indianapolis, IN 46225

Re: American Chemical Service, Inc. (ACS)
IND016360265
Financial Assurance for Closure

Dear Mr. Stevens:

As directed by 3291AC-3-22-3, ACS has completed the Closure Plan and Closure Cost Estimates for the Container Storage Area (Location A), Reclamation Crude Tank Farm (Location B), Injectant and Blending Stock Tank Area (Location C) and the Reclamation Still Facility (Location D). The Closure Cost Estimates per facility as of this date are as follows:

A. Container Storage Area (Location A)
Reclamation Crude Tank Farm (Location B)
Injectant and Blending Stock Tank Area (Location C)
Reclamation Still Facility (Location D)

Total estimated cost -	$106,827.00
Contingency factor (10%)	10,682.70
Closure Cost Estimate	117,509.70

B. Former Solids Mixing Area (Presently engaged in closure (activities due for completion January 1991)

Total estimated cost	$ 72,359.00
Contingency factor (10%)	7,235.00
Closure Cost Estimate	79,594.00

Total Closure Cost Estimates	$197,103.70

Page 2
Mr. Jeffrey W. Stevens

As of August 1990, the Holdings of the financial Assurance for Closure trust Fund (Acct. No. 0100000001) held at the First National Bank, Valparaiso, IN, is sufficient to cover the current Cost Estimates for Closure and the annual inflation adjustment for 1990. A copy of the Trust Ledger is attached to this letter.

Sincerely,

John J. Murphy
Vice President
American Chemical Service, Inc.

JJM/rl

Enclosure

FIRST NATIONAL BANK
VALPARAISO • PORTAGE • HEBRON
CHESTERTON • KOUTS
INDIANA
(219) 462-4161

TRUST DEPARTMENT

08-03-90

STATEMENT OF HOLDINGS

ACCOUNT NUMBER: 0100000001

DESCRIPTION: FIRST NATIONAL BANK, VALPARAISO
TRUSTEE
AMERICAN CHEMICAL SERVICES, INC.

SECURITY NUMBER	ASSET NAME	LOT/TYPE	SHARES/PAR VALUE	BOOK VALUE	DIV RATE	MATURITY DT
00089833410	FEDERATED CASH MANAGEMENT FUND # 59 U. S. GOVERNMENT OBLIGATIONS	01/024	213,116.50	213,116.50	7.767	
93973500275	FIRST NATIONAL BANK, VALPARAISO CERTIFICATE OF DEPOSIT #39735 DUE 9 3 90 7.875%	01/006	100,000.00	100,000.00	7.875	09-03-90
ACCOUNT TOTAL *				313,116.50		